

CHAPTER 4

ANALYSIS OF ENVIRONMENTAL CONSEQUENCES

4.0 INTRODUCTION

This chapter of the environmental assessment (EA) provides an analysis of the potential environmental consequences that would result from implementation of the proposed Pacific Rim Shallow Gas project. Certain measures that would avoid or reduce impacts under the Proposed Action have been included in Chapter 2. The following impact assessment takes these measures into consideration. Additional opportunities to mitigate impacts beyond the measures proposed in Chapter 2 are presented in this chapter for each resource discipline.

An environmental impact or consequence is defined as a modification or change in the existing environment brought about by the Proposed Action or alternatives to the Proposed Action. Impacts can be direct or indirect in nature, and can be permanent (long-term) or temporary (short-term). Impacts can vary in degree ranging from only a slight discernable change to a drastic change in the environment. Short-term impacts are impacts that occur during and immediately after construction and testing and last from two to five years. For purposes of this EA, short-term impacts are defined as lasting five years or less. Long-term impacts are impacts imposed by construction and operations that remain longer than five years and extend for the life of the project and beyond.

The description of the environmental consequences for each resource section in this chapter includes the following subsections:

Impacts - The level and duration of impacts that would occur as a result of the Proposed Action or the No Action Alternative. The impact evaluation assumes that the applicant-committed practices described in Chapter 2 would be implemented

Mitigation - A summary of additional measures that could be applied to avoid or reduce impacts. Mitigation items specified in the Mitigation Summary are *assumed to be* applicable to impacts on all lands, regardless of ownership. However, Warren would coordinate with private land owners to determine which measures would be applied, to what degree, and where. Also, because of the similarity between the Proposed Action and No Action, it is assumed that the mitigation described applies to both alternatives. The measures identified under this section would be considered for application on public lands administered by the BLM. If no additional mitigation is proposed, the mitigation and residual impact sections will not be discussed.

Residual Impacts - A summary of impacts that are unavoidable and cannot be reduced or eliminated through the application of available and reasonable mitigation and, therefore, would remain throughout the duration of the project and to some point beyond.

Cumulative Impacts - A description of impacts likely to occur due to this project in combination with other on-going and recently approved activities, recently constructed projects and other past projects, and projects likely to be implemented in the near future (reasonably foreseeable developments or RFDs). Cumulative impacts associated with the Proposed Action and alternatives are summarized in Chapter 5 of this EA.

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Unavoidable adverse impacts, short-term use of the environment versus long-term productivity, and irreversible and irretrievable commitment of resources are discussed in separate sections following the discussions of the specific resources (Sections 4.16, 4.17, and 4.18 respectively). Unavoidable adverse impacts cannot be avoided and cannot be completely mitigated. Short-term use of the environment covers the life-of-project (LOP), whereas long-term productivity refers to the period after the project is completed and the area reclaimed. Irreversible and irretrievable impacts are permanent reductions or losses of resources that, once lost, cannot be regained.

4.1 GEOLOGY/MINERALS/PALEONTOLOGY

4.1.1 Geology

4.1.1.1 Direct and Indirect Impacts

4.1.1.1.1 Proposed Action

Impacts could occur to the geologic environment as a result of the Proposed Action. If alteration of existing land surface results in steepening slopes, increasing runoff, undercutting that could initiate slumping, landsliding, or other mass movements, or results in accelerating erosion of existing valley heads. Implementation of mitigation measures and procedures for soils and water resources described in Chapter 2 would make the probability of such impacts unlikely.

Impacts could occur to the geologic environment, as well as project facilities as a result of inherent geologic hazards (e.g., landslides, mass movements, earthquakes), but this is considered unlikely. No landslides or mass movement deposits are mapped within the PRPA and no known earthquake epicenters are recorded within the area.

4.1.1.1.2 No Action Alternative

Under the No Action Alternative approximate LOP surface disturbance on federal lands (25.8 acres) is less than that of the Proposed Action (153 acres). Although the magnitude of impacts could be greater for the Proposed Action, the types of potential impacts for the two alternatives are the same.

4.1.1.2 Mitigation

No additional mitigation to the geologic environment is proposed.

4.1.1.3 Residual Impacts

No residual impacts to the geologic environment are identified.

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4.1.2 Minerals

4.1.2.1 Direct and Indirect Impacts

4.1.2.1.2 Proposed Action

Inventory of mineral resources in the PRPA revealed no major mineral resources that would be impacted by implementation of the Proposed Action and No Action Alternative other than natural gas resources reserves. Successful field development would result in natural gas resources production and depletion, if permitted by federal and state agencies, and therefore should not be considered an adverse impact. Shallow gas is the primary mineral resources that would be impacted. Production of these resources would generate public and private revenue.

Construction grade materials are likely to be used from local sources (in the PRPA and surrounding areas) for surfacing materials for oil and gas facilities. If development is extensive, known accumulations of local materials may become depleted and additional sources outside of, or within, the PRPA would need to be identified and used. The magnitude of impacts depends on the number of roads, well pads, and other facilities built under each alternative.

4.1.2.1.2 No Action Alternative

The approximate LOP surface disturbance on federal lands (25.8 acres) for the No Action Alternative is less than that of the Proposed Action (153 acres). Although the magnitude of impacts could be greater for the Proposed Action, the types of potential impacts are the same for both alternatives. However, under the methods prescribed in the No Action Alternative, the natural gas resources available utilizing current technologies may not be able to be extracted to their fullest extent.

4.1.2.2 Mitigation

No mitigation to the mineral environment is proposed. It is assumed that all drilling and completion activities as described in Chapter 2 will follow standard applicable requirements of the WOGCC and federal and local agencies.

4.1.2.3 Residual Impacts

Depletion of natural gas reserves is an unavoidable impact associated with implementation of the Proposed Action or the No Action Alternative.

4.1.3 Paleontology

4.1.3.1 Direct and Indirect Impacts

4.1.3.1.1 Proposed Action

Direct impacts to fossils would include damage or destruction of scientifically significant fossil resources during construction, with subsequent loss of information. Adverse indirect impacts would include fossil damage or destruction by accelerated erosion due to surface disturbance. In addition, improved access and increased visibility could result in unauthorized fossil collection or vandalism of fossil resources.

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The Proposed Action could result in direct and indirect impacts to fossil resources caused by surface disturbance, particularly where disturbances will affect the Fort Union, Wasatch and Green River Formations. These formations are known contain or have a high potential to contain, fossils of scientific importance (BLM Paleontology Class 5).

The Fort Union, Wasatch, and Green River Formations which underlie the PRPA are ranked as Class 5 formations. According to the Probable Fossil Yield Classifications (PYCF) under development by the BLM Wyoming State Office (Hanson 2003, Blackburn 2004), class 5 formations include highly fossiliferous geologic units that regularly and predictably produce either vertebrate fossils or scientifically significant non-vertebrate fossils. Such formations are at risk of natural degradation, human-caused adverse impacts, or both, and require appropriate consideration during environmental evaluation of potential affects to paleontology of surface disturbing activities. No comprehensive surveys have been conducted for fossils in the PRPA, but it is likely that the Fort Union, Wasatch, and Green River Formations have unidentified fossil resources in them within the project boundaries. As a result, excavation in the Fort Union, Wasatch, and Green River Formations could reveal fossils of scientific significance that would otherwise have remained buried and unavailable for scientific study. Newly discovered fossils would be available for future scientific study as long as they are properly collected and catalogued into a museum repository along with associated geologic data. In this way significant positive consequences including the unanticipated discovery of previously unknown scientifically significant fossils, could result.

4.1.3.1.2 No Action Alternative

The approximate LOP surface disturbance on federal lands (25.8 acres) for the No Action Alternative is significantly lower than that of the Proposed Action (153 acres). Although the magnitude of impacts could be greater for the Proposed Action, the types of potential impacts are the same for the two alternatives.

4.1.3.2 Mitigation

The magnitude of potential impacts to fossil resources can be reduced by the implementation of paleontological resource mitigation measures described below.

Areas underlain by the Fort Union, Wasatch, and Green River Formations should be surveyed by a BLM-permitted paleontologist prior to construction disturbance and monitored during excavation, if such a recommendation is appropriate. If fossil resources are uncovered as a result of survey of lands slated for disturbance associated with the Proposed Action or No Action Alternative, the project proponent and authorized personnel should immediately notify the BLM for consideration for further action. If such fossil resources are discovered during surface disturbance, work should cease immediately in the area of the discovery until the fossil remains can be evaluated for scientific significance by a BLM-permitted paleontologist.

If fossil remains of significance are identified either during survey or during excavation then additional mitigation may be proposed as necessary. Additional mitigation could include collection, identification, and curation of the fossil remains and potentially monitoring of on-going surface disturbance in the area of discovery.

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4.1.3.3 Residual Impacts

No residual impacts to fossil resources are identified.

4.2 AIR QUALITY

4.2.1 Direct and Indirect Impacts

4.2.1.1 Proposed Action

4.2.1.1.1 Summary

Proposed Action emission sources would include those resulting from well development, well production, and gas compression and processing. This includes increased vehicle traffic and drilling activity during the construction phase of the Proposed Action, followed by continuous generator engine and natural gas compressor engine emissions. Air pollutant emissions from these sources would include oxides of nitrogen (NO_x), carbon monoxide (CO), particulate matter less than 10 and 2.5 microns in effective diameter (PM₁₀, PM_{2.5}) and volatile organic compounds (VOCs). Results indicate that formaldehyde would be the primary hazardous air pollutant (HAP) emitted from the Proposed Action sources. Emissions of benzene, toluene, ethylbenzene and xylenes (BTEX) compounds and n-hexane would be inconsequential due to the composition of the produced gas.

Total estimated emissions for the Proposed Action are summarized in Table 4-1. All development related emission calculations, which include well pad and resource road construction, well drilling, and well completion, assume an average development rate of 65 wells per year (60 gas wells and 5 injection wells) over a two-year period. A total of 120 gas wells would produce an estimated 48 MMscf/day of natural gas.

Table 4-1. Proposed Action Emission Summary

Pollutant	Emissions (tons/year)				Total Estimated Emissions (tons/year)
	Well Development	Well Production	Well Subtotal	Gas Compression and Dehydration	
NO _x	93.3	37.8	131.2	168.6	299.8
CO	24.6	39.4	64.1	56.4	120.5
VOC	6.9	37.8	44.7	113.6	158.3
SO ₂	1.6	0.0	1.6	0.0	1.6
PM ₁₀	86.1	0.0	86.1	0.2	86.2
PM _{2.5}	16.6	0.0	16.6	0.2	16.8
Formaldehyde	0.1	1.9	1.9	7.8	9.7

The individual sources of Proposed Action related emissions are discussed below. Detailed emission calculations for each activity are available in Appendix A-1.

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Construction, Drilling, and Well Development Emissions

During the construction phase, vehicle and fugitive dust emissions would increase within the PRPA. Vehicle emissions would result from work crews commuting to and from the work site and from the transportation and operation of construction equipment. Vehicle tailpipes would emit small quantities of NO_x and CO. Fugitive dust concentrations would increase with additional vehicle traffic on unpaved roads and from wind erosion in areas of soil disturbance. Drill rig operations would result mainly in an increase of NO_x and CO emissions. Emission rates were calculated using applicable EPA emission factors and anticipated level of operational activities, such as estimated vehicle trips, load factors, and hours of operation.

Construction, drilling, and well development emissions are not anticipated to have substantial effects on air quality within the PRPA or the surrounding cumulative assessment area for the following reasons:

- Due to the limited scope (restricted to locations where construction is actively taking place), the adequate well spacing (160-acre), and the short-term nature of these emissions (two year development period), the aggregate impact of vehicle tailpipe, fugitive dust, and drill rig emissions would be minimal over the 10-20 year life of the Proposed Action. Construction activities and associated emissions from a well and its associated road and pipeline would not likely overlap in time and space with a nearby well.
- Pollution impacts from new road construction activities will be minimized through use of the existing improved road network, which represents 40% of proposed access roads. The unimproved BLM road network will also be used where appropriate, further reducing the need for new road construction.
- Results from significantly larger Actions such as the Draft Environmental Impact Statement/Draft Planning Amendment for the Powder River Basin Oil and Gas Project and the Desolation Flats Natural Gas Field Development Project Environmental Impact Statement (USDI-BLM 2002; USDI-BLM 2003) suggest that well development emissions will not have a substantial affect over the life of the Proposed Action.

Compressor and Generator Engines

Five natural gas compressor stations, each consisting of two 1,150 horsepower (hp) compressors and one dehydrator would be constructed and operated. For analysis purposes, it was assumed that Caterpillar 3516 TALE lean-burn compressor engines would be utilized at all proposed compressor locations. This engine type has been permitted by the Wyoming Department of Environmental Quality, Air Quality Division (WDEQ-AQD 2003) at an initial compressor site within the PRPA. The compressors represent the primary Proposed Action source of NO_x and CO emissions at 166.6 and 55.5 tons per year, respectively. The dehydrator burner emissions are inconsequential at two tons per year of NO_x and less than one ton per year of CO. The compressors and dehydrators would also emit lesser amounts of VOCs.

Each gas and injection well would require a pump powered by electricity during well development and to initiate and maintain production. Additionally, several transfer stations operating small centrifugal pumps to transport produced water from the gas well to the water injection well may also be needed. Temporary natural gas-fueled generators located within the central compressor stations are proposed to generate the electricity needed to operate these

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pumps. Once permanent electrical distribution lines are constructed, electricity will be supplied from an electric utility substation or high voltage line. For analysis purposes, it was assumed that each gas and injection well, on average, would require a pump rated at 30 hp, for a total power requirement of 3,900 hp. Additionally, it was assumed that Caterpillar G3516 SITA rich-burn generator engines would be used at all proposed generator locations. This engine type has been permitted by the WDEQ-AQD (2003) at an initial central generator site within the PRPA. At emission rates of 1 gram per horsepower-hour, generator engines are estimated to account for 37.7 tons per year of both NO_x and CO emissions.

4.2.1.1.2 Criteria Pollutant Impacts

The latest version of the EPA-approved Industrial Source Complex Short-Term (ISCST3) dispersion model was applied with regulatory default options to predict maximum criteria pollutant and formaldehyde air quality impacts. Proposed Action sources included in the modeling analysis were compressor and generator engines located at five central stations. Five years of Rock Springs surface and corresponding Lander upper air meteorological data (1991-1995) provided by the WDEQ-AQD were utilized in the modeling analysis. Adjustments to annual predicted NO_x concentrations were made in accordance with the Ambient Ratio Method (ARM) as specified in EPA's Guideline on Air Quality Models (EPA 2003a). The ARM accounts for the atmospheric conversion of nitric oxide (NO) to nitrogen dioxide (NO₂).

The Proposed Action sources were evaluated against significance criteria for NO_x and CO emissions. Tables 4-2 and 4-3 compare the maximum predicted air quality impacts with the appropriate National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) Class II increments. Since there are no PSD increments for CO, only the NO₂ increment is presented in Table 4-3. As shown, the predicted impacts are substantially less than the applicable NAAQS and PSD Class II increments.

Table 4-2. Proposed Action Impact Comparison to NAAQS

Pollutant and Averaging Time	Maximum Proposed Action Impact (µg/m ³)	Background Concentration (µg/m ³)	Maximum Proposed Action Impact Plus Background (µg/m ³)	National and Wyoming Ambient Air Quality Standard (µg/m ³)	Percent of NAAQS
NO ₂ Annual	10.9	3.4 ^a	14.3	100	14%
CO 1-hour	597.8	2,299 ^b	2896.8	40,000	7%
CO 8-hour	126.3	1,148 ^b	1274.3	10,000	13%

^a Data collected at Green River Basin Visibility Study site, Green River, Wyoming during the period June 10, 1998 – December 31, 2001 (ARS 2002)

^b Data collected at Rifle and Mack, Colorado in conjunction with proposed oil shale development during the early 1980's (CDPHE-APCD 1996)

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Table 4-3. Proposed Action Impact Comparison to PSD Increments

Pollutant and Averaging Time	Maximum Proposed Action Impact ($\mu\text{g}/\text{m}^3$)	PSD Class II Increment ($\mu\text{g}/\text{m}^3$)	Percent of Increment
NO ₂ Annual	11	25	44%

4.2.1.1.3 Hazardous Air Pollutant Impacts

Hazardous air pollutant emissions were evaluated for short-term (acute), long-term (chronic), and carcinogenic effects by comparison to Environmental Protection Agency (EPA) recommended thresholds. Test results indicate the absence of typical HAP constituents in the gas stream that would be processed through the dehydrators. However, low levels of formaldehyde (CH₂O) would be emitted from the compressor and generator engine sources.

To assess the potential chronic health effects of CH₂O in comparison to EPA guidelines, predicted annual concentrations were compared to reference concentrations (RfCs) for chronic exposure (EPA 2002). The RfCs represent an estimate of the continuous inhalation exposure rate to the human population (including sensitive subgroups such as children and the elderly) without an appreciable risk of harmful effects during a lifetime.

In addition, the EPA has summarized a set of acute dose-response levels, used by different agencies for different purposes, for assessing potential short-term (e.g., on the order of 1-hour) HAP exposures (EPA 2003b). The most relevant for assessing acute exposures from routine releases of chemicals are Reference Exposure Levels (RELs), used by the California Environmental Protection Agency (CalEPA). The RELs are derived specifically to assess routine, short-term (1-hour) exposures to chemicals.

The use of RfCs and RELs for HAP evaluation represents a departure from past analyses. In previous NEPA studies, a range of state acceptable concentration levels were utilized as the significance criteria. The basis for the state acceptable concentration levels was the National Air Toxics Information Clearing House (NATICH) database, which is now considered outdated. The RfCs are derived from the most current scientific data. In addition, previous studies did not include an assessment of acute effects.

Tables 4-4 and 4-5 present the REL and RfC, respectively, for CH₂O. The predicted 1-hour concentration is compared to the listed REL and the predicted annual average concentration is compared to the listed chronic exposure RfC. As the results illustrate, predicted concentrations are below the thresholds, suggesting that no acute or chronic adverse health effects would be expected from the Proposed Action.

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Table 4-4. Formaldehyde Acute Reference Exposure Level Comparison

Hazardous Air Pollutant	Maximum Predicted One-Hour Concentration ($\mu\text{g}/\text{m}^3$)	Acute Reference Exposure Level (REL) ($\mu\text{g}/\text{m}^3$) ^a	Percentage of REL
Formaldehyde	30.0	94	32%

^a Source: EPA (2003b).

The EPA has classified formaldehyde as a probable human carcinogen of medium carcinogenic hazard with an inhalation unit risk factor of $1.3 \times 10^{-5} (\mu\text{g}/\text{m}^3)^{-1}$ (inverse micrograms per cubic meter) (EPA 1994).

Table 4-5. Formaldehyde Chronic Reference Concentration Comparison

Hazardous Air Pollutant	Maximum Predicted Annual Concentration ($\mu\text{g}/\text{m}^3$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$) ^a	Percentage of RfC
Formaldehyde	0.7	9.8	7%

^a Source: EPA (2002).

The analysis considered two exposure scenarios. The Maximum Exposure Scenario assumed that a person could be continuously exposed to the maximum concentration for the life of the project, which is 20 years. Considering the remoteness of the project and the absence of any nearby residences, a more realistic scenario, termed the Most Likely Exposure (MLE), was also evaluated. The Most Likely Exposure Scenario assumed a person would be exposed 40 hours per week, 50 weeks per year, for 20 years.

Table 4-6 presents the estimated incremental carcinogenic risks. Applying the predicted maximum annual formaldehyde concentration of $0.68 \mu\text{g}/\text{m}^3$ and assuming a maximum exposure scenario of 24 hours per day for 20 years, the incremental formaldehyde cancer risk is estimated at 2.5 incidents per one million exposures. This estimated formaldehyde risk is slightly higher than the EPA significance criteria of 1.0 incidents per million exposures. This method of analysis, however, is extremely conservative based on the assumption that persons would be continuously exposed to the maximum model predicted concentration of formaldehyde for 24 hours per day over a 20-year period. Furthermore, the maximum predicted concentrations of formaldehyde were observed at locations very close to the proposed compressor stations and decreased rapidly with distance, indicating that an occupational exposure scenario would be most appropriate.

Applying a more realistic occupational exposure scenario or MLE, the incremental risk is estimated at 0.6 incidents per million exposures, below the EPA significance criteria of 1.0 incident per million exposures.

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Table 4-6. Potential Incremental Carcinogenic Risk

Hazardous Air Pollutant	Incremental Carcinogenic Risk Resulting from the Maximum Exposure Scenario	Incremental Carcinogenic Risk Resulting from the Most Likely Exposure Scenario
Formaldehyde	2.5 incidents in one million	0.6 incidents in one million

4.2.1.1.4 Air Quality Related Value Impacts

The latest version of the CALPUFF dispersion model was used, in the screening mode, to estimate the Proposed Action impacts on Air Quality Related Values (AQRVs) for selected areas of special concern. Five years of Rock Springs surface meteorological data (1985, 1987-1990) were applied in the analysis. Proposed Action sources included compressor and generator engines, wind erosion, drill rig, and vehicle dust and tailpipe emissions. Predicted results were evaluated against visibility, dry and wet nitrogen deposition, and acid neutralization capacity (ANC) criteria for the areas of special concern listed in Table 4-7.

Visibility Impacts

Potential visibility impairment was evaluated in terms of the change in deciview (Δ dv). The deciview index was developed as a linear perceived visual change. A change in visibility of 1.0 dv represents a “just noticeable change” by the average person under most circumstances. Increasing deciview values represent proportionately larger perceived visibility impairments. The Forest Service uses a 0.5 Δ dv as a level of acceptable change (LAC) threshold in order to protect visibility in sensitive areas. A 1.0 Δ dv threshold is used in the Regional Haze Regulations and has been used by other agencies as a management threshold. The 0.5 and 1.0 Δ dv thresholds are neither standards nor regulatory limits. Rather, they are used to alert the affected land managers that potential adverse visibility impacts may exist and the land manager may wish to look at the magnitude, duration, frequency, and source of the impacts in more detail in order to make a significance determination.

For the Proposed Action, a screening level analysis for visibility was applied following the recommendations in the Federal Land Managers Air Quality Related Values Workgroup (FLAG) (2000) Guideline document. The pollutants responsible for potential visibility impairment resulting from the Proposed Action are primary PM₁₀ and secondary nitrate particulate matter. Potential 24-hour concentrations for these pollutants were modeled for the special concern areas. These values were then applied in a comparison to background conditions (using monthly site-specific $f(RH)$ relative humidity adjustments; EPA 2003c) by calculating a potential change in deciview. Regional background particulate concentrations from the FLAG (2000) Phase I Report for Bridger Wilderness were applied for all areas of special concern listed in Table 4-7.

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Table 4-7. Areas of Special Concern

Special Concern Area	PSD Classification	Distance ^a from Proposed Action (mi)	Direction from Proposed Action
Bridger Wilderness	Federal PSD Class I	125	NNW
Fitzpatrick Wilderness	Federal PSD Class I	145	NNW
Popo Agie Wilderness	Federal PSD Class II	145	NNW
Wind River Roadless	Federal PSD Class II	125	NNW
Savage Run Wilderness	State PSD Class I	120	E

^a Distance from the center of the PRPA to the center of the area of concern.

For the Proposed Action alone, no impacts exceeding the 0.5 or 1.0 Δ dv LAC thresholds were predicted using FLAG (2000) data. Table 4-8 lists the predicted maximum impacts for each special concern area applying FLAG background extinction values. See Appendix A-2 for model results using Interagency Monitoring of PROtected Visual Environments (IMPROVE) background.

Dry and Wet Deposition Impacts

Dry deposition fluxes were predicted for gaseous NO_x and nitric acid (HNO_3), as well as particulate nitrate (NO_3^-). Wet deposition fluxes were predicted for NO_3^- . Results are reported in total (wet + dry) N deposition. Since the Proposed Action is not anticipated to be a substantial source for sulfur based chemical species, the calculation of sulfur deposition fluxes was not warranted.

Incremental N fluxes resulting from Proposed Action emission sources were evaluated against both total-load and project-level deposition thresholds. Deposition Analysis Thresholds (DATs) were established jointly by the National Park Service (NPS) and U.S. Fish and Wildlife Service (FWS) to assess project-level deposition impacts at Class I areas. The DAT is the additional amount of deposition that triggers a management concern, not necessarily the amount that constitutes an adverse impact to the environment. Table 4-9 indicates that the maximum project-level N deposition predicted for each area of special concern is below the DAT of 0.005 $\text{kg ha}^{-1} \text{yr}^{-1}$ for Western Class I areas (National Park Service 2003).

Predicted total N deposition (Proposed Action plus background) was compared to the USDA-Forest Service Bridger “level of concern” value of 3 $\text{kg ha}^{-1} \text{yr}^{-1}$ (defined as the acceptable level of total deposition) and “red line” value of 10 $\text{kg ha}^{-1} \text{yr}^{-1}$ (defined as the total deposition an area can tolerate) (Fox et al 1989). Table 4-10 indicates that Proposed Action impacts on total N deposition, in conjunction with the maximum annual background deposition recorded at Pinedale, WY between 1989-2000 (as recommended in the FLAG [2000] Phase I report), are predicted to be below these threshold values for all areas of special concern.

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Table 4-8. Predicted Visibility Impacts From the Proposed Action

Special Concern Area	Maximum Visibility Impact, FLAG Background Data (Δ dv)	Visibility Significance Criteria (Δ dv)	Number of Days Greater than or equal to 0.5Δ dv	Number of Days Greater than or equal to 1.0Δ dv
Bridger Wilderness	0.38	0.5 / 1.0	0	0
Fitzpatrick Wilderness	0.37	0.5 / 1.0	0	0
Popo Agie Wilderness	0.47	0.5 / 1.0	0	0
Savage Run Wilderness	0.40	0.5 / 1.0	0	0
Wind River Roadless	0.42	0.5 / 1.0	0	0

Table 4-9. Proposed Action Incremental Nitrogen Deposition Impact

Special Concern Area	Nitrogen Deposition Analysis Threshold (DAT) ^a ($\text{kg ha}^{-1} \text{yr}^{-1}$)	Maximum Proposed Action Nitrogen Deposition ($\text{kg ha}^{-1} \text{yr}^{-1}$)	Maximum Percent of DAT
Bridger Wilderness	0.005	0.0012	24%
Fitzpatrick Wilderness	0.005	0.0008	16%
Popo Agie Wilderness	0.005	0.0012	24%
Savage Run Wilderness	0.005	0.0009	18%
Wind River Roadless	0.005	0.0009	18%

^a Source: National Park Service (2003).

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Acid Neutralization Capacity Impacts

An analysis of potential changes to Acid Neutralization Capacity (ANC) was performed for each of six sensitive lakes (Table 4-11) using the procedure recommended by the USDA – Forest Service (2000). This procedure incorporates predicted deposition results in a comparison to background ANC values for the lakes of concern. Calculated Proposed Action impacts were compared to a 10 percent change in ANC for lakes with background ANC values equal to, or above, 25 microequivalents per liter ($\mu\text{eq/l}$). For Upper Frozen Lake with a background ANC value of less than 25 $\mu\text{eq/l}$, the results were compared to a threshold of no more than one $\mu\text{eq/l}$ total change in ANC. The results indicate that potential changes in lake ANC due to Proposed Action impacts alone are expected to be well below established LAC threshold values.

4.2.1.2 No Action Alternative

Impacts to air quality under the No Action Alternative would occur at levels similar in nature to, but on a smaller scale than, those described under the Proposed Action. Under this alternative, additional gas development could occur through the approval of individual wells on Federal lands. Development on State and private lands would continue though Wyoming Oil and Gas Conservation Commission approval. No substantial air quality impacts are anticipated under this alternative.

Table 4-10. Proposed Action Total Nitrogen Deposition Impact

Special Concern Area	Maximum Proposed Action Nitrogen Deposition ($\text{kg ha}^{-1} \text{yr}^{-1}$)	Background Nitrogen Deposition ($\text{kg ha}^{-1} \text{yr}^{-1}$) ^a	Total Nitrogen Deposition ($\text{kg ha}^{-1} \text{yr}^{-1}$)	Total Percent of Bridger “Level of concern” ^b	Total Percent of Bridger “Red Line” ^c
Bridger Wilderness	0.0012	1.6	1.6	53%	16%
Fitzpatrick Wilderness	0.0008	1.6	1.6	53%	16%
Popo Agie Wilderness	0.0012	1.6	1.6	53%	16%
Savage Run Wilderness	0.0009	1.6	1.6	53%	16%
Wind River Roadless	0.0009	1.6	1.6	53%	16%

^a Maximum annual N deposition measured at Pinedale between 1989-2000 (Source: Pinedale CASTNet and NADP).

^b Bridger “level of concern” equal to 3 $\text{kg ha}^{-1} \text{yr}^{-1}$ (Fox et al 1989).

^c Bridger “red line” equal to 10 $\text{kg ha}^{-1} \text{yr}^{-1}$ (Fox et al 1989).

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Table 4-11. Proposed Action Acid Neutralization Capacity Impact

Lake Name	Special Concern Area	Background ANC Concentration ^a (µeq/l)	Level of Acceptable Change	Proposed Action Change in ANC
Black Joe	Bridger Wilderness	67.0	10%	0.02%
Deep	Bridger Wilderness	59.9	10%	0.02%
Hobbs	Bridger Wilderness	69.9	10%	0.01%
Upper Frozen	Bridger Wilderness	5.0	1 µeq/l	0.01 µeq/l
Ross	Fitzpatrick Wilderness	53.5	10%	0.01%
Lower Saddlebag	Popo Agie Wilderness	55.5	10%	0.02%

^a Background ANC values compiled from 24 data files supplied by the USDA-FS (2003). Background levels represent 10% lowest ANC as measured at lake outlet.

4.2.1.3 Air Quality Impacts Summary

No substantial adverse impacts to air quality are anticipated as a result of the Proposed Action and the No Action Alternative. Localized increases in NO_x, CO, and PM₁₀ concentrations would occur under both Alternatives, but maximum concentrations would be below applicable Federal and State standards. Hazardous air pollutant health risks and incremental increases in cancer risk would be below applicable significance levels. Potential impacts to visibility, acid neutralization capacity, and total nitrogen deposition would be below the levels of acceptable change.

4.2.3 Mitigation

Potential air quality impacts resulting from the Proposed Action could be reduced through the implementation of engineering control or other measures.

NO_x Mitigation

The primary sources of NO_x emissions associated with the Proposed Action are the natural gas-fueled compressor engines and well pump sources. The following potential mitigation measures could reduce impacts from NO_x emissions. The appropriate level of control will be determined and required by the WDEQ-AQD during the pre-construction permit process.

- In the permitting of compressor engines, the WDEQ-AQD always requires application of the Best Available Control Technology (BACT) process. As a result of the BACT process, emissions rates for compressor engines 100 hp and greater average 1.0 g/hp-hr NO_x. With the application of non-selective catalytic reduction, NO_x emissions for some compressor engines can be reduced to 0.7 g/hp-hr.

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- Compressors and well pump sources powered by electric motors could reduce NO_x emissions within the immediate project area. However, increased NO_x emissions are likely to result at the point of electrical generation.
- Proposed Action related NO_x emissions could be offset through the application of controls at non-project sources.

Particulate Matter Mitigation

The primary Proposed Action related sources of particulate matter result from vehicle travel on unpaved roads and wind erosion. The following mitigation measures could reduce project related impacts from particulate emissions:

- Roads and well locations constructed on soils susceptible to wind erosion could be appropriately surfaced to reduce the amount of fugitive dust generated by vehicle traffic.
- Water or other dust suppressants could be applied as necessary on unpaved roads and construction areas to reduce problem fugitive dust emissions.
- Operators could establish and enforce speed limits on all project related unpaved roads to reduce vehicle fugitive dust.

4.2.3 Residual Impacts

Despite application of mitigation efforts, implementation of the Proposed Action would result in minor increases in air pollutant emissions throughout the life of the project. As previously discussed, however, the increased pollutant concentrations resulting from the Proposed Action are not anticipated to exceed NAAQS thresholds, PSD increments, or HAP thresholds. Similarly, the Proposed Action is not likely to impact AQRVs such as visibility, acid neutralization capacity, or total nitrogen deposition at levels above the respective LACs.

4.3 SOILS

4.3.1 Direct and Indirect Impacts

4.3.1.1 Proposed Action

Impacts resulting from drill pad, access road, facility site, and pipeline ROW construction could include removal of vegetation, exposure of the soil, mixing of soil horizons, soil compaction, loss of topsoil productivity, and increased susceptibility of the soil (and underlying bedrock) to wind and water erosion, undercutting, collapse or subsidence, or accelerated headward erosion. The magnitude of the potential impacts will ultimately vary proportionally with the number of wells ultimately drilled and the total amount of associated disturbance. Further information on impacts to soils from the implementation of the Proposed Action is described in section 4.4.1.1.1, Surface Water.

4.3.1.2 No Action Alternative

The approximate LOP surface disturbance on federal lands (25.8 acres) for the No Action Alternative is lower than that of the Proposed Action (153 acres). Although the magnitude of impacts would be greater for the Proposed Action than the No Action Alternative, the types of potential impacts are the same. Potential impacts to soils are similar for the Proposed Action

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and No Action Alternative, because both alternatives involve the drilling of oil and gas wells and building of supporting infrastructure.

4.3.2 Mitigation

No mitigation to the soil environment is proposed.

4.3.3 Residual Impacts

No residual impacts to soils are identified.

4.4 WATER RESOURCES

4.4.1 Direct and Indirect Impacts

4.4.1.1 Proposed Action

4.4.1.1.1 Surface Water

Potential impacts that could occur to the surface water system due to the Proposed Action include increased surface water runoff and off-site sedimentation due to soil disturbance (Soils Section 4.3), water quality impairment of surface waters, and stream channel morphology changes due to road and pipeline crossings. The magnitude of the impacts to surface water resources would depend on the proximity of the disturbance to a drainage channel, slope aspect and gradient, degree and area of soil disturbance, soil character, duration of construction activities, and the timely implementation and success/failure of mitigation measures. Impacts would likely be greatest shortly after the start of construction activities and would decrease in time due to stabilization, reclamation, and revegetation efforts. Construction activities would occur over a relatively short period of time; therefore, the majority of the disturbance would be intense but short-lived. Petroleum products and other chemicals could be accidentally spilled resulting in surface water contamination. Similarly, reserve and evaporative pits could leak if liners were punctured or no liners were installed, resulting in surface and subsurface water degradation.

The primary impact of the Proposed Action on surface water resources is the potential for increasing surface runoff, erosion, and off-site sedimentation that could cause channel instability and degradation of surface water quality. As described in Chapter 2, total new short-term surface disturbance resulting from the Proposed Action would be 498 acres (approximately 1.0 percent of the total PRPA which encompasses about 47,598 acres). This total would include 149 acres of new surface disturbance from well locations (including on-site gathering, measurement, and compressor facilities), 144 acres of new roads or upgrades of existing roads, and 205 acres of new pipeline construction. The construction disturbance would not be uniformly distributed across the project area, but rather, project facilities would be located where the efficiency and feasibility of extracting the natural gas would be the highest as discussed in Chapter 2. Locating of project facilities on slopes in excess of 25 percent would be avoided.

The primary roads utilized to access the PRPA are WYO 430, SCR 19, SCR 24, and SCR 76. The existing road network was developed to access prior drilling, ongoing drilling, and production activities, as well as other land use activities on Federal surface. All new access

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roads would be constructed in accordance with WSO BLM Manual 9113 Supplement. This is to minimize soil erosion due to road construction and use, thereby minimizing impacts to surface water from these actions. There will be no authorized use of unimproved roads to access wells or other facilities. The Proposed Action assumes the construction of no more than 120 wells and associated roads and pipelines. Roads will be designed to minimize disturbance, and all surface disturbance will be contained within the road ROW. In the event drilling is non-productive, all disturbed areas, including the well site and new access road, would be reclaimed to the approximate landform that existed prior to construction. If drilling is productive, all access roads to the well site would remain in place for well servicing activities. Partial reclamation would be completed on segments of the well pad and access road ROW no longer needed. The PRPA would have a maximum of 35.64 miles (129.6 acres) of new roads or upgrades of existing roads with a 30-foot wide average disturbance, and 35.64 miles (129.6 acres) of new gas and water collection lines would be installed in a 30-foot wide facilities corridor. An average of 0.33 mile of new or upgraded roads and 0.33 mile of new gas gathering and water discharge lines per well would be constructed and installed.

The majority of soil disturbance would be well away from stream channels as required by GRRMP management directives. Authorization of the Proposed Action would require full compliance with the RMP management directives that relate to surface water protection, Executive Order 11990 (floodplains protection), and the CWA in regard to protection of water quality and compliance with Section 404 permits. These directives require avoidance of stream channels to the maximum extent possible. Where total avoidance is not possible, the minimization of impacts to streams and associated floodplains/floodways must be implemented and the operator would be required to show the BLM AO why such resources cannot be avoided and how impacts would be minimized. These regulations also require that certain permits/authorizations be obtained for project implementation including a NPDES permit (needed for surface discharge); development of a surface runoff, erosion, and sedimentation control plan; oil spill containment and contingency plan; as well as CWA Section 404 permits. Given these conditions, adverse sedimentation is not expected to occur as a result of the implementation of the Proposed Action.

Most of the ephemeral drainage channels identified on Figure 3-8 are classified as waters of the U.S. Crossings of these channels and any associated wetlands would require authorization from the COE through the CWA Section 404 permitting process. However, these channel crossings would likely receive expedited authorization from the COE through Nationwide Permits No. 12 (buried utility lines) and/or No. 14 (minor road crossing fills) and No. 18 (minor discharges) as well as Programmatic General Permit 98-08. Other project facilities could not be located in waters of the U.S., and therefore, Section 404 permitting would not be necessary for such facilities. Each individual channel crossing would be reviewed during the APD/RPW permitting process for specific permit requirements under Section 404 and the CWA. Given these conditions, wetland damage is not expected to occur as a result of the implementation of the Proposed Action.

There is a remote chance that road and pipeline construction across established channels could adversely modify flow hydraulics. However, with correct design of channel crossings, including design for 25- to 50-year runoff events, no adverse impacts are expected. As discussed in Chapter 3, all drainage channels in the project area are ephemeral. Therefore, it is unlikely that increased sedimentation would adversely affect water quality of surface waters.

Reserve pits would be utilized to contain drilling fluids, cuttings, and water produced during drilling. The reserve pit would be lined as needed with an impermeable liner to prevent

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seepage. Bentonite or synthetic lining would be used where appropriate as defined during the APD review. The synthetic liner would be at least 12 mils thick, reinforced with a bursting strength of 174 x 175 pounds per inch (ASTMD 75719), resistant to decay from sunlight and hydrocarbons, and compatible with the drilling fluids to be retained. Leakage of the pit fluids would be minimal from lined reserve pits unless the liners were installed incorrectly or the liners were damaged during drilling operations. Thus, adverse impacts from leaks in lined reserve pits would likely not occur. At least two feet of freeboard on all reserve pits would be maintained to ensure the pits are not in danger of overflowing. If leakage is found outside the pit, drilling operations would be shut down until the problem is corrected.

Water for use in drilling the wells would be obtained from properly permitted sources near the project area, from wells previously drilled in the project area, or from Rock Springs, Wyoming. The project would require approximately 4,500 barrels of water per well, assuming no re-use of drilling water, for completion, well stimulation, and dust control. This water demand is relatively small and would not adversely affect existing surface or groundwater sources or rights. For conservation purposes, water used to drill one well may also be used for drilling subsequent wells.

The method used for the disposal of produced water (water produced in association with the shallow gas, which is separated out at the well location) would be accomplished by disposal in one or more injection wells. Subsurface injection of produced water, as opposed to surface discharge, would protect surface water quality by reducing impacts such as increased soil erosion, degradation of surface water quality, and decreased permeability of surface soils that may occur if produced water is discharged in surface ponds or ephemeral drainages. The operator would obtain the permits necessary for the selected disposal method. Depending on timing of availability, quantity, and quality of produced water, some of the produced water could be used in well drilling and completion, pipeline construction, and hydrostatic testing.

Handling and management of hydrostatic test water, if used by the operator, would be accomplished in a manner that does not adversely affect soils, stream channels, and surface water and groundwater quality. After testing operations are completed, the water would be pumped into water hauling trucks and transported to drilling locations within the project area and used in conjunction with the drilling operations. However, if such water were not re-used it would be disposed of in a manner where soil scouring and water quality impairment would not result. Hydrostatic test water would be evaluated for compliance with State water quality standards. No test water would be discharged unless such water meets these standards. Test water not needed for drilling operations that meets water quality standards would be disposed of onto undisturbed land having vegetative cover or into an established drainage channel in a manner as to not cause accelerated erosion.

If drilling is productive and a well is completed for production, site erosion and off-site sedimentation would be controlled by promptly revegetating surface disturbance in the first appropriate season (fall or spring) after drilling, and providing surface water drainage controls, such as berms, sediment collection traps, diversion ditches, and erosion stops as needed. These measures would be described in the individual APD/ROW.

4.4.1.1.2 Groundwater

The primary impact of the Proposed Action on groundwater resources is best described as the loss of hydraulic pressure head in the affected coal seam aquifer. The removal of groundwater

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from the coal aquifer results in the reduction of the hydraulic pressure head, thus lowering the water levels in nearby wells completed in the same coal seam. The lowering of water levels in an aquifer is also referred to as drawdown.

A description of the geology and hydrology of the Pacific Rim Shallow Gas Project is given in Chapter 3. The focus of this groundwater impact assessment is the coal seam aquifers within the Almond Formation, a member of the Upper Cretaceous Mesaverde Group. These targeted coal seams are classified as confined to semi-confined aquifers because they are bound by aquitards consisting of impervious to semi-pervious layers of shale and siltstone. Hydraulic connection between the Almond Formation coal seams and any aquifer stratigraphically above or below the coal seams is therefore very limited. The hydrostatic pressure head of the water measured in coal seam test wells completed in the project area can be considerably higher than the aquifer elevation at any respective well location. Confined, or artesian, aquifer conditions of this type are indicative of an effective seal or aquitard above and below the aquifer. However, lowering of the hydraulic pressure head in the coal seam aquifer by dewatering activities may induce a slight leakage of water through the semi-pervious shale layers into the pumped aquifer. Due to extremely low hydraulic conductivity of the confining layers, enhanced leakage from any aquifer stratigraphically above or below the dewatered coal seams would be minimal, and only after a period of time would drawdown effects in any overlying aquifer become apparent.

Currently, the lack of site-specific data within the project area does not justify the use of a three dimensional groundwater drawdown model, such as the U.S. Geological Survey's Three-Dimensional Finite Difference Modular Groundwater Flow Model, MODFLOW (McDonald & Harbaugh 1988) to predict drawdown impacts. The data necessary for a model of this type includes elevations, hydraulic conductivities, and potentiometric surfaces for the coal seam(s) and confining layers. Until additional drilling and testing are conducted and data of these types are collected, the use of a simpler planning-level model is justified. Therefore, the areal extent of drawdown within the coal aquifer due to the removal of water for the shallow gas project was estimated using an aquifer analysis model that is based on equations describing transient flow to pumping wells developed by Theis (1935). This model provides a conservative prediction of the potential drawdown resulting from groundwater pumpage at a well or group of wells. The assumptions used with this model are that the aquifer is isotropic (aquifer properties do not vary with direction), homogeneous (aquifer properties do not vary with location), of infinite areal extent, and lies horizontally. Obviously, these simplifying assumptions are not met by the Almond Formation coal seams in the Proposed Action area; however, use of these simplifying assumptions is likely to result in a conservative analysis, with drawdowns overstated as compared to what are likely to occur. As described below, the aquifer's hydraulic and physical parameters used in the model were derived from both the literature and from actual field measurements.

It was further assumed that the aquifer is confined (a storage coefficient of 0.0002 was used) and that the confining layers are leaky. The available head, which is the height to which water would rise measured from the bottom of the aquifer, was estimated using the hydrostatic pressure heads gauged in existing shallow gas wells.

Long-term, steady-state shallow gas well water production data within the Proposed Action area is presently unavailable. Short-term tests on recently completed shallow gas wells indicate that discharge rates are highly variable. An anticipated long-term, steady-state discharge rate of five gpm was assigned to each of the 120 shallow gas well locations to simulate the Proposed Action. The locations of these 120 pumping wells were distributed in the locations proposed in the Pacific

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Rim Unit Field Map. In order to present a conservative estimate, the model simulated these 120 wells pumping five gpm continuously for a period of 20 years. The resulting average extent of drawdown was then contoured, as shown in Figure 4-1. In reality, discharge rates may exceed this amount at the onset of production but will decline over time, likely reaching zero in the later stages of the project. This is because as the formation pressures drop, the gas will begin to flow more freely into the well and much less water will need to be produced.

This model predicts that, after 20 years the 10-foot drawdown contour in the coal will extend approximately 11 miles north, 12 miles east, and 10 miles south of the PRPA. Ten feet of drawdown represents less than one percent of the estimated available head in this area. Water levels in the Almond Formation coal seam aquifer are predicted to decline as much as 2,000 feet within the PRPA (Figure 4-1)

Due to the approximate nature of the Theis aquifer model, drawdowns predicted between the PRPA and the coal seam outcrop are simplified. The total available drawdown between the project area and the coal outcrop/subcrop trace is unknown, and it is conservatively assumed that the affected coal seam would be completely dewatered in these areas. Again, in light of the available data, the Theis model was considered to be the best representation of the dewatering stresses imposed by the proposed shallow gas project. With more data available in the future, a numerical model (e.g., MODFLOW) could be applied.

The reduction of hydraulic pressure head in the affected coal seam aquifer would mean that the probability is high that any well completed in the same Almond Formation coal seam within the area of influence (the projected 10 foot drawdown contour) may be impacted.

No springs or seeps have been identified within the project area. If any should be discovered during the life of the project, the exact locations and associated water-bearing strata of such surface expressions of groundwater would be evaluated during the site-specific analysis conducted for all components at the APD stage. Due to coal seam depths in the PRPA, it is unlikely that drawdown in the coal seam would adversely affect springs or seeps in the project area if any were to be located. Further, all construction activities and storage of petroleum products would be kept away from any seeps and springs (a minimum distance of 200 to 600 feet depending on the type of spring); therefore, contamination would be unlikely.

In addition to drawdown in the affected coal seam aquifer, the geologic unit(s) chosen for the subsurface disposal of shallow gas produced water will also be affected. At this time, little data are available to describe the geologic unit(s) that will be the injection target. Depths of the disposal wells are expected to range from 3,000 to 7,500 feet. Data would be collected on potential host units during the drilling and completion of the shallow gas wells and the new disposal/injection wells, if needed. Information from these sources will allow the operator to more accurately predict shallow gas water production data and the depths, hydrostatic pressures, permeabilities, and other technical information necessary to assess impacts to subsurface geologic units chosen as injection zones. In general, the principle impact resulting from subsurface water disposal will consist of an increase in hydrostatic pressure in the geologic unit(s) chosen as the injection zone. It is unlikely that the water quality of the native groundwater in the host aquifer(s) would be degraded because the produced water would likely be of equal or higher quality than that of the injection zone. The produced water would be gathered from aquifers that occur at shallow depths in relatively close proximity to recharge areas, where groundwater would be fresher and have smaller concentrations of dissolved solids relative to that of an aquifer occurring at greater depth that would be targeted for disposal.

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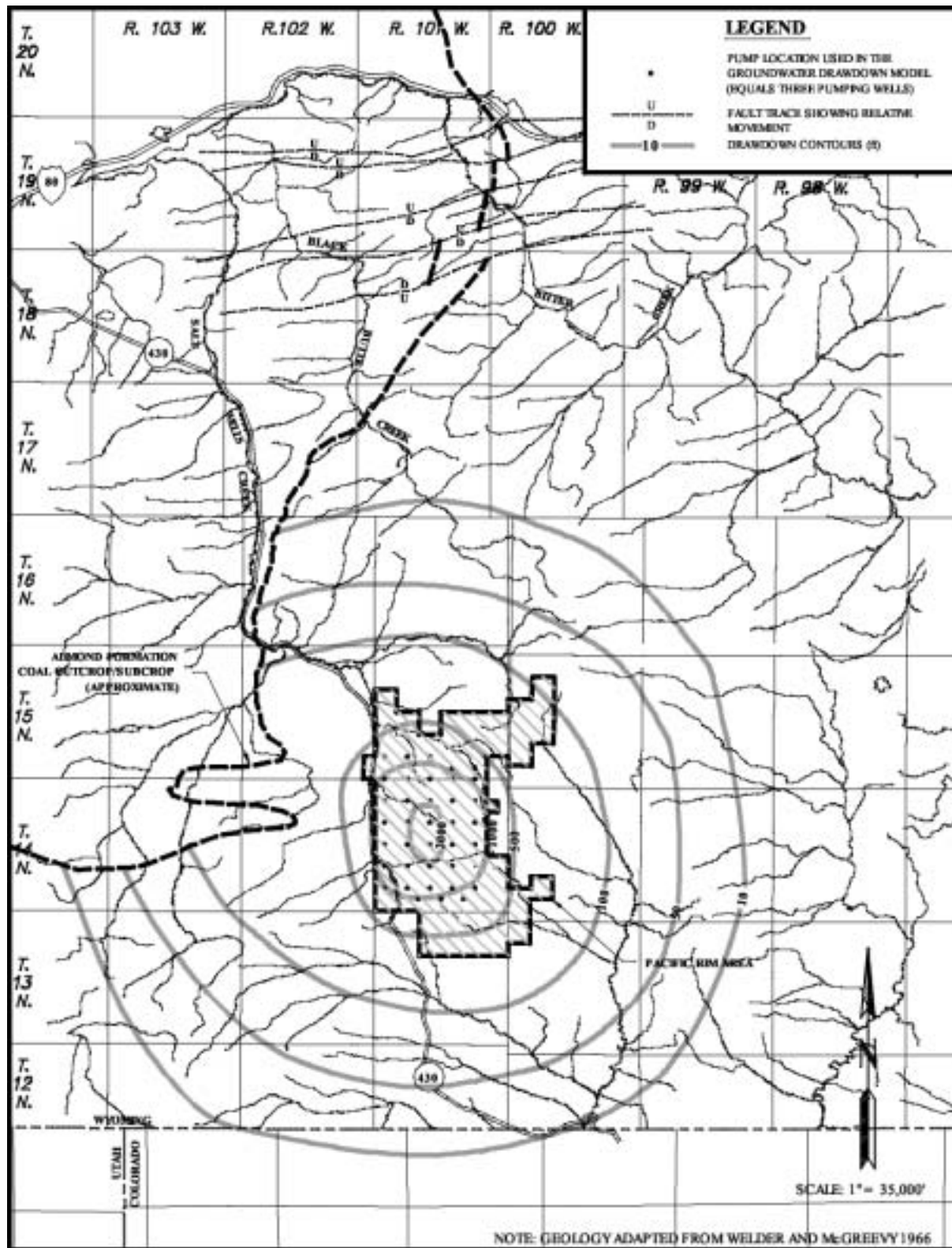


Figure 4-1. Modeled Maximum Extent of Drawdown Within the Almond Formation Coal Aquifer Due to the Proposed Action.

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Groundwater from the deeper host aquifer(s) is further from recharge areas and as a result of increased contact time with the host rock would have higher dissolved solids concentrations than groundwater occurring in shallower aquifer units.

In the event that an injection well ceases to operate properly due to formation over-pressuring or mechanical failure, the operator must still remain in compliance with all applicable regulations governing the operation of the produced water disposal system. Compliance options available to the operator include curtailing or halting the rate of water production or routing the discharge to additional injection wells. Well drilling and completion should not have an adverse effect on groundwater quality. Poor drilling and completion techniques could result in degradation of groundwater due to the mixing of variable quality waters from different water-bearing strata that happen to be pierced by the borehole. The magnitude of mixing, if any, which would occur during the relatively short period of time during drilling, would be relatively small. In addition, due to the state-of-the-art drilling and well completion techniques, the possibility of serious degradation of groundwater quality by the Proposed Action would be very low. The improbable degradation of groundwater quality within any aquifers in the project area essentially eliminates the possibility of adverse effects to the identified water rights holders (Chapter 3).

4.4.1.2 No Action Alternative

Impacts to water resources with implementation of the No Action Alternative would be similar to the Proposed Action, but have a much lesser magnitude.

4.4.2 Mitigation

Warren proposes to implement mitigation measures, procedures, and management requirements on public lands administered by the BLM to avoid or mitigate resource or other land use impacts. These measures would be applied on privately owned surface and State of Wyoming lands unless otherwise specified by the involved private and/or State surface owners. An exception to a mitigation measure and/or design feature may be approved on public land on a case-by-case basis when deemed appropriate by the BLM. An exception would be approved only after a thorough, site-specific analysis determined that the resource or land use for which the measure was put in place is not present or would not be significantly impacted.

The following measure would further reduce potential impacts resulting from the Proposed Action: Should any existing permitted groundwater rights (water wells) be adversely affected by the Proposed Action, Warren should rework, replace, or otherwise compensate the owner/permittee.

4.4.3 Residual Impacts

No adverse residual impacts would result from project implementation.

4.5 VEGETATION, WETLANDS AND NOXIOUS WEEDS

4.5.1 Direct and Indirect Impacts

4.5.1.1 Proposed Action

The Proposed Action assumes construction of 120 shallow gas wells and associated roads and pipelines. Construction and installation of well sites, access roads, and ancillary facilities

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(compressor's, pipelines, etc.) would directly reduce the extent of vegetation cover types. Over the estimated 1 to 3 year development phase, the Proposed Action would initially disturb an estimated 497.5 surface acres (Table 2-1), which represents about 1.2% of the total land surface of the project area (43,159.6 acres). During the projected 10 to 20 year life-of-project (LOP), the initial 497.5 disturbed acres would gradually decrease to about 153.0 acres dependent upon time required for successful reclamation. The estimated LOP acreage represents about 0.4% of the total land surface of the project area. As stated in Section 2.0, if initial drilling attempts are unsuccessful or uneconomical, the possibility exists that Warren would abandon the proposal.

Analysis of construction disturbance upon primary vegetation cover types is based on the approximate location of proposed wells prior to construction; actual placement of wells may change as drilling proceeds and reservoir characteristics are determined. For purposes of this analysis it was assumed that surface disturbance associated with the Proposed Action would occur in proportion to the area of each vegetation type within the project area. Four vegetation types cover less than 200 acres of the PRPA and it is unlikely that any wells would occur in those vegetation types (Table 4-12). Disturbance of those vegetation types would primarily be related to roads and pipeline construction. Based on these assumptions, an estimated 80 wells would be located in the Wyoming big sagebrush primary cover type with a total disturbance of 329.4 acres or about 1.2% of this primary cover type (Table 4-12). This amount would decrease to about 100.7 acres for the LOP, or 0.4% of the Wyoming big sagebrush vegetation cover type in the PRPA (Table 4-12). The remaining 40 wells would be located in the saltbush fans and flats, Vasey big sagebrush, desert shrub, Utah juniper, Basin big sagebrush, birdsfoot sagebrush, and greasewood fans and flats vegetation cover types; see Table 4-12 for disturbance estimates in each vegetation type. No more than 1.2% of any vegetation type is expected to be disturbed during initial development and no more than 0.4% over the LOP.

In general, the extent of impacts upon vegetation will be influenced by success of mitigation and reclamation efforts and the time period required for disturbed areas to return to pre-existing conditions. Reclamation success, in part, depends on the amount of surface area disturbed and quality of topsoil salvaged and stockpile/redistribution methods in disturbed areas, precipitation, soil type, and moisture availability. Reseeding and reclamation efforts could proceed after cessation of surface-disturbing activities and original contour and grade would be achieved as discussed in Section 2.2.10 and 2.2.10.1.

Table 4-12. Estimated disturbance of vegetation cover types (acres) on the Pacific Rim Project Area – Proposed Action.

				Disturbance - Initial		Disturbance - LOP	
	Acres	% of PRPA	Est. # Wells	Acres	% of Type	Acres	% of Type
Wyoming big sagebrush	28633.2	66.3%	80	329.4	1.2%	100.7	0.4%
Saltbush fans and flats	3900.0	9.0%	11	45.8	1.2%	14.4	0.4%
Vasey big sagebrush	3013.1	7.0%	8	35.3	1.2%	11.5	0.4%
Desert shrub	2751.9	6.4%	8	32.3	1.2%	9.9	0.4%
Utah juniper	2323.3	5.4%	7	27.7	1.2%	8.5	0.4%
Basin big sagebrush	1251.1	2.9%	4	14.5	1.2%	4.1	0.3%

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Birdsfoot sagebrush	535.6	1.2%	1	5.4	1.0%	1.6	0.3%
Greasewood fans and flats	361.5	0.8%	1	4	1.1%	1.2	0.3%
True mountain mahogany	164.8	0.4%	0	1.3	0.8%	0.5	0.3%
Black sagebrush	125.9	0.3%	0	1	0.8%	0.3	0.2%
Desert shrub/limber pine	90.6	0.2%	0	0.7	0.8%	0.3	0.3%
Shadscale	8.5	0.0%	0	0.1	1.2%	0	0.0%
Totals	43159.5	100%	120	497.5		153.0	

Disturbance of the primary vegetation cover types within the PRPA would not be significant because of the small percentage of disturbance within the PRPA and their abundance and wide area of distribution in this area of southwestern Wyoming. Despite the difficulty of establishing vegetation in upland sites with <10 inches average annual precipitation, current technology exists to stabilize these areas and minimize soil erosion as natural succession returns the site to pre-existing conditions. Any potential impacts will be minimized assuming construction, maintenance, and operation of well pad sites and associated disturbances are in accordance with Chapter 2 of this EA, APD stipulations, and RMP requirements.

Potential indirect impacts to the vegetation resource may occur as a result of soil compaction, mixing of soil horizons, loss of topsoil productivity, increased soil surface exposure, soil loss due to wind and water erosion, compressional/shear damage to biological soil crusts, and increased potential for invasive plant establishment.

Indirect impacts to the vegetation resource would be minor with implementation and compliance of, mitigation measures and stipulations stated in Chapter 2 of this EA, Warren's APDs, and the RMP, realizing that full reclamation to pre-existing vegetation conditions (especially the shrub component) may require several decades in the arid environment of the project area, dependant in great part, to future climatic conditions and land-use patterns.

4.5.1.1.1 Wetlands

Due to a paucity of wetland/riparian sites on the PRPA, the probability of well pads, roads, or pipelines impacting these resources is low. The RMP specifies that a 500 foot (minimum) buffer around riparian and other water resources will be avoided. Permits under Section 404 of the Clean Water Act would be required for any activities in wetlands or waters of the United States. Warren would be required to demonstrate to the COE that there are no "practical alternatives" to placement of a well location in a wetland. The probability of impacting wetlands and other waters of the U.S. under the Proposed Action is low given the xeric nature of the PRPA and identified mitigation procedures as stated in Chapter 2 (Sections 2.2.11.2.5-6-7 & 8), Warren's APD stipulations, the RMP, COE and BLM surface-disturbing guidelines.

4.5.1.1.2 Biological Soil Crusts

Surface disturbing activities have the potential to negatively impact biological soil crusts if they are present. Potential impact of a disturbance to crustal organisms is affected by its type, severity, size, frequency, duration, and timing (Belnap et al. 2001). Compressional/shear disturbance to biological soil crusts would most likely occur due to off-road vehicle use and trampling (such as from vehicles and trampling by humans and animals). Loss of biological soil

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crusts by burying is inevitable with road construction, trenching, and other operations that remove vegetation and topsoil.

Impacts to biological soil crusts can be minimized by limiting off-road vehicle activity (especially heavy construction equipment, trucks, pickup, and cars). Vehicle tracks often channel water off-site resulting in slowing or preventing their recovery and increasing erosion potential. Vehicles (e.g. all-terrain vehicles or ATVs) with high-flotation tire exert less force to the soil surface but may disrupt crusts by rapid turns which shear the topsoil.

4.5.1.1.3 Noxious Plant Species

Surface disturbing activities could increase the potential for infestation and spread of invasive plant species. Invasive weed species usually thrive on newly disturbed surfaces such as road and pipeline ROWs and out-compete the more desirable native plant species. As explained in Section 2.2.11.2.1, Warren would be responsible for the management and control of all invasive (including noxious) weed species infestations on project-related surface disturbances during the projected LOP and would consult with the BLM Authorizing Officer (AO) and/or local Sweetwater County Weed and Pest Control District authority for acceptable weed control methods.

Appendix 9-2 of the RMP provides guidelines for herbicide utilization within the RSFO management area. In addition, Appendix 5-1 of the RMP specifies that herbicide loading sites will be located at least 500 feet from live water, floodplains, riparian areas, and all special status plant locations. In addition, aerial spraying of chemicals would be prohibited within 1/4 mile of special plant locations, and hand application would be prohibited within 500 feet. Control measures would adhere to those authorized in the *FEIS, Vegetation treatment on BLM lands in the thirteen western states* (USDI-BLM 1991).

4.5.1.2 No Action Alternative

Under the No Action Alternative, direct and indirect vegetation impacts would continue as additional individual exploratory and development activities beyond this EA are considered by the BLM on a case-by-case basis for individual APDs on federal lands. Additional gas development would occur on State and private lands within the PRPA under APDs approved by the WOGCC. Transport of natural gas products would be allowed from those wells in the PRPA that are in current production.

The No Action Alternative assumes construction of 12 wells with associated roads and pipelines. Construction and installation of well sites, access roads, pipelines, and ancillary facilities would directly reduce the extent of these vegetation cover types. Over the estimated 1 to 3 year development phase of the project, the No Action Alternative would involve a total initial disturbance of about 73.3 acres; the majority of this disturbance would likely occur in the Wyoming big sagebrush cover type. During the LOP and with successful reclamation, this total would decrease to about 25.8 acres.

Potential impacts to wetlands and waters of the U.S., biological soil crusts, and invasive plants would be similar to those described under the Proposed Action, but of a much lesser magnitude.

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4.5.2 Mitigation

No additional mitigation would be required.

4.5.3 Residual Impacts

No residual impacts to the vegetation resource would take place.

4.6 RANGELAND RESOURCES

4.6.1 Direct and Indirect Impacts

4.6.1.1 Proposed Action

Under the Proposed Action, an estimated 497.5 total (federal, state, private) acres will initially be disturbed which represents about 0.03% of the total land area (1,946,321 acres) of the Rock Springs and Vermillion Creek grazing allotments. During the LOP, this total is estimated to decrease to about 153.0 acres which represents about 0.008% of the total land area of the two allotments.

Sheep and cattle grazing would continue throughout the duration of the project. The primary impact to grazing resources would be short-term loss of available forage as a result of construction and production-related disturbance. Table 4-13 summarizes and compares, both for the Proposed Action and the No Action Alternative, the estimated initial disturbed acres with those during the LOP and corresponding AUM impacts.

Table 4-13. Estimated Reduction of Animal Unit Months in the Rock Springs (No. 13018) and Vermillion Creek (No. 04003) Grazing Allotments due to Land Surface/Vegetation Disturbance for the Proposed Action and No Action Alternatives.

PROPOSED ACTION ¹				
Land Ownership Status	Estimated Total Initial Disturbed Area (acres)	Estimated Total Initial Animal Unit Months (AUM) Reduction	Estimated Total Life-of-Project (LOP) Disturbance Area (acres)	Estimated Total Life-of-Project (LOP) Animal Unit Months (AUM) Reduction
Federal	455.5	43.4	138.1	13.2
State	14.0	1.3	4.7	0.5
Private	28.0	2.7	9.3	0.9
TOTAL	497.5	47.4	153.0	14.6
NO ACTION ALTERNATIVE ²				
Federal	29.5	2.8	10.4	1.0
State	14.0	1.3	4.7	0.5
Private	29.8	2.8	10.7	1.0
TOTAL	73.3	6.9	25.8	2.5

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- 1 See Table 2-1 for individual gas field component acreage for the Proposed Action.
- 2 See Table 2-4 for individual gas field component acreage for the No Action Alternative.

Assuming all 120 wells are successful, the Proposed Action would result in an estimated initial 497.5 acres of short-term disturbance (about 1.2% of the total project area) or about 0.03% of the 1,946,321 acres encompassed within the Rock Springs and Vermillion Creek grazing allotments (Lloyd 2004). During the anticipated LOP, this total is estimated to decrease to about 153.0 acres (0.4% of the total project area) or about 0.008% of the total land area of the two grazing allotments.

For purposes of this analysis, a stocking rate of 10.5 acres/AUM is used. This figure was determined by averaging the current stocking rate for the Rock Springs grazing allotment (10 acres/AUM) and the stocking rate for the Vermillion Creek grazing allotment (11 acres/AUM)(see Table 3-15). Based on this stocking rate, the Proposed Action would result in a short-term loss of about 47.4 AUMs, and a LOP loss of about 14.6 AUMs. These amounts are substantially less than one percent of the permitted 193,780 AUMs for the combined Rock Springs and Vermillion Creek allotments (Lloyd 2004).

Successful reclaimed sites produce at a rate of about 6 acres per AUM (USDI-BLM 1999b), which is almost twice the present 10.5 acres per AUM stocking rate used in this analysis. Reclamation of disturbed sites with grasses and forbs could cause a localized increase in the availability of livestock forage and depending upon the intensity of use (grazing by wildlife, wild horses, and livestock), could interfere with revegetation success of reclaimed areas. Fencing may be required to avoid overuse and to assure successful reclamation of the site.

Prevention and control of invasive weed species would be a positive impact to livestock by reducing competition with indigenous plants, thereby maximizing forage production. The Proposed Action would increase the potential for livestock/vehicle collisions. However, if Warren advises project personnel regarding appropriate speed limits on designated access roads as specified in Chapter 2 of this EA, and these instructions are complied with, the likelihood of livestock/vehicle collisions would be minimized.

Direct and indirect impacts to the grazing resource are anticipated to be minor and short-term. The primary direct impact to the grazing resource would be a short-term loss of available forage as a result of construction and production-related disturbance. Indirect impacts of the proposed project on grazing resources may result from increased human and vehicle activity that may increase the potential for livestock/vehicle collisions. However, if Warren advises project personnel regarding appropriate speed limits on designated access roads as specified in Chapter 2, and these instructions are complied with, the likelihood of livestock/vehicle collisions would be minimized.

Sheep and cattle grazing would continue throughout the duration of the project. Warren could coordinate with affected livestock operators to minimize disruption during livestock operations, including calving and lambing. All gates should be closed after opening. If fences are breached due to operations they would be repaired as quickly as possible.

Implementation/compliance of mitigation measures and stipulations stated in Chapter 2 of this EA, Warren's APDs, and the RMP, would minimize potential direct and indirect impacts to the grazing resource.

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4.6.1.2 No Action Alternative

Impacts resulting from the implementation of this alternative would be similar, but reduced in scope, to those described under the Proposed Action. Under the No Action Alternative, disturbances to the rangeland resource located in proximity to roads and existing facilities would continue due to vehicular use and continued gas field-related activities. Consideration of individual APDs by the BLM on federal lands could continue on a case-by-case basis through individual project and site-specific environmental analysis. Additional gas development could occur on State and private lands within the PRPA under APDs approved by the WOGCC.

Under the No Action Alternative, an estimated 73.3 acres (Proposed Action = 497.5 acres) would be initially disturbed due to continuing gas-related activity which represents about 0.2% of the PRPA land surface area and about 0.004% of the total land area of the Rock Springs and Vermillion Creek grazing allotments. As site reclamation proceeds, the estimated LOP disturbance acres would be reduced from 73.3 acres to 25.8 acres which represents about 0.06% of the PRPA and 0.001% of the total land area of the Rock Springs and Vermillion Creek grazing allotments (Table 4-13).

Under the No Action Alternative, the estimated reduction of initial AUMs would be about 6.9 AUMs which represents about 0.004% of the total permitted AUMs for the Rock Springs and Vermillion Creek grazing allotments. The estimated LOP reduction in total AUMs would stabilize at about 2.5 AUMs or about 0.001% of the total permitted AUMs for both allotments (Table 4-13).

4.6.2 Mitigation

No additional mitigation would be required.

4.6.3 Residual Impacts

No adverse residual impacts are expected to occur as a result of project implementation.

4.7 WILDLIFE

4.7.1 Direct and Indirect Impacts

4.7.1.1 Proposed Action

Over the proposed 1 to 3 year drilling period, approximately 120 shallow gas wells would be drilled, with 108 of those wells occurring on federal land. The development would initially disturb approximately 497.5 acres of general wildlife habitat. The precise number and location of wells may change as directed by the success of developmental drilling, production technology, and economic profitability. The exact locations of proposed development sites are not known; therefore, for the following impact analysis, it was assumed that placement of wells and other project facilities would occur evenly across the project area.

During the production phase, the unused portion of well sites and roads, as well as pipelines (a total of 344.5 acres) would be reclaimed, reducing the life-of-project disturbance to approximately 153 acres. Following completion of production operations (life of the project is estimated at 10-20 years), the well field and ancillary facilities would be reclaimed and

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abandoned, well pads would be removed, and the areas revegetated with seed mixes approved by the BLM, some of which are specifically designed to enhance wildlife use. The duration of impacts to vegetation would depend, in part, on the success of mitigation and reclamation efforts and the time needed for natural succession to return revegetated areas to predisturbance conditions. Grasses and forbs are expected to become established within the first several years following reclamation; however, much more time would be required to achieve reestablishment of shrub communities. Consequently, disturbance of shrub communities, particularly mixed shrub communities that big game utilize during winter, would result in a long-term loss of those habitats.

In addition to the direct loss of habitat due to construction of well pads and associated roads and pipelines, disturbances from human activity and traffic would lower the utilization of habitat immediately adjacent to these areas. Species that are sensitive to indirect human disturbance (noise and visual disturbance) would be impacted most. Habitat effectiveness of these areas would be lowest during the construction phase when human activities are more ubiquitous and intensive. Disturbance would be reduced during the production phase of operations and many animals would become accustomed to equipment and facilities in the gas field and may once again use habitats adjacent to disturbance areas.

4.7.1.1.1 General Wildlife

The direct disturbance of approximately 497.5 acres of wildlife habitat under the Proposed Action would reduce habitat availability and effectiveness for a variety of common small mammals, birds and their predators. The initial phases of surface disturbance would result in some direct mortality and displacement of songbirds and small mammals from construction sites. In addition, some increase in mortality from increased vehicle use of roads in the project area is expected. Quantification of these losses is not possible; however, the impact is likely to range from low to moderate over the short-term. Due to the relatively high production potential of these species and the relatively small amount of habitat disturbed, small mammal and songbird populations would quickly rebound to pre-disturbance levels following reclamation of pipelines, unused portions of roads, well pads, and wells that are no longer productive. No long-term adverse impacts to populations of small mammals and songbirds are expected.

4.7.1.1.2 Big Game

In general, impacts to big game wildlife species would include direct loss of habitat and forage, and increased disturbance from drilling, construction, and maintenance operations. Disturbance of big game species during the parturition period and on winter range can increase stress and may influence species distribution (Hayden-Wing 1980, Morgantini and Hudson 1980). There may also be a potential for an increase in poaching and harassment of big game, particularly during winter. The potential for vehicle collisions with big game would likely increase as a result of increased vehicular traffic associated with the presence of construction crews and would continue (although at a reduced rate) throughout all phases of the operations.

Mule Deer. The project area supports mule deer year round. Approximately 17.7% of the project area is classified as mule deer crucial winter/yearlong range and 82.3% of the project area is classified as mule deer winter yearlong range. An estimated 21 wells would be located in mule deer crucial winter/yearlong range; total disturbance associated with these wells would be approximately 87.6 acres (Table 4-14), or 1.1% of the crucial winter/yearlong range in the project area. Following reclamation, approximately 27.1 acres of crucial winter/yearlong range

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would remain disturbed for the remaining life of the project. An estimated 99 wells would be located in winter yearlong range, disturbing a total of 409.9 acres, or 1.2% of the winter yearlong range in the project area. Following reclamation, approximately 125.9 acres of winter yearlong range would remain disturbed for the remaining life of the project.

During winter, mule deer primarily utilize shrubs including sagebrush, mountain mahogany, and antelope bitterbrush (DeBolt 2000). Mountain mahogany is also important mule deer forage during the spring, summer, and fall (DeBolt 2000). Specific placement of roads and wells to avoid destroying habitat patches containing these shrub species would lessen the impact upon the crucial winter range vegetation in the project area. Overall, impacts upon mule deer winter habitat should be limited and no long-term significant impacts to mule deer in the area are expected because a very small percent (0.03%) of the crucial winter/yearlong range within the South Rock Springs Herd Unit would be disturbed and similar habitats are available in the surrounding area.

Disturbance is also a factor that should be considered for big game species. According to management directives in the RMP, crucial big game winter ranges will be closed from November 15 - April 30. This closure of areas located in mule deer crucial winter/yearlong range would eventually eliminate disturbance to mule deer wintering on the project area. This closure would also limit the potential for poaching and/or harassment of mule deer.

No significant adverse impacts upon the mule deer population utilizing the project area are expected provided that mitigation measures contained in this document and the RMP are implemented. These measures include using species for reclamation that are native and that provide quality forage for big game.

Elk. Nearly all of the project area is classified as elk yearlong range (94.9%). The remainder of the project area (5.1%) is not classified as any type of elk seasonal range. An estimated 114 wells would be located in elk yearlong range; total disturbance associated with these wells would be approximately 472.2 acres (Table 4-14), or 1.2% of the yearlong range in the project area. Following reclamation, approximately 145.1 acres of elk yearlong range would remain disturbed for the remaining life of the project. The remainder of the disturbance from the proposed action would be located in areas not designated as any type of elk seasonal range. During winter, elk utilize most of the same shrub species preferred by mule deer, but prefer grasses when they are available. Spatial separation of elk and mule deer on the winter range may occur (Hayden-Wing 1980), but they often utilize the same areas (DeBolt 2000). Impacts upon elk habitat are expected to be minor because no crucial winter range would be disturbed and only 1.2% of the yearlong range in the project area would be disturbed in the short-term. Overall, no significant adverse impacts upon the elk population utilizing the project area are expected provided that mitigation measures contained in this document and the RMP are implemented. These measures include using species for reclamation that are native and that provide quality forage for big game.

Pronghorn. The project area supports pronghorn throughout the year. Approximately 84.5% of the project area is classified as winter yearlong pronghorn range, and approximately 15.5% of the project area is classified as crucial winter/yearlong pronghorn range. An estimated 101 wells would be located in winter yearlong pronghorn range; total disturbance associated with these wells would be approximately 418.2 acres (Table 4-14), or 1.1% of the winter yearlong pronghorn range in the project area. Following reclamation, approximately 128.2 acres of winter yearlong pronghorn range would remain disturbed for the remaining life of the project. An

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estimated 19 wells would be located in crucial winter/yearlong pronghorn range; total disturbance associated with these wells would be approximately 79.3 acres, or 1.2% of the crucial winter/yearlong pronghorn range in the project area. Following reclamation, approximately 24.8 acres of crucial winter/yearlong pronghorn range would remain disturbed for the remaining life of the project.

Pronghorn crucial winter/yearlong range is located in the southern and extreme western portions of the project area and winter yearlong range covers the remainder of the project area. Activities associated with the construction phase of the project would likely temporarily displace pronghorn, however, once construction is complete pronghorn would likely habituate and return to pre-disturbance activity patterns. Reeve (1984) found that pronghorn acclimated to increased traffic volumes and machinery as long as the traffic and machines moved in a predictable manner. The displacement of pronghorn and disturbance of habitats is expected to be a minor impact because of the temporary nature of the displacement and the availability of comparable habitats in adjacent areas.

According to management directives in the RMP, crucial big game winter ranges will be closed from November 15 - April 30. This closure of areas located in pronghorn crucial winter/yearlong range would reduce disturbance to pronghorn wintering on the project area. This closure would also limit the potential for poaching and/or harassment of pronghorn. No significant adverse impacts upon the pronghorn population utilizing the project area are expected provided that mitigation measures contained in this document and the RMP are implemented. These measures include using species for reclamation that are native and that provide quality forage for big game.

Big Game Summary. Overall, the entire project area is used year-round by at least three (3) big game species (antelope, mule deer, or elk). Significant impacts to populations of big game utilizing the PRPA are not expected with development of the Proposed Action. The southern portion of the project area provides crucial habitat for antelope, while the southwestern and extreme northeastern portions of the project area provide crucial habitat for mule deer. A small area in the southwestern portion of the project area (662 acres) includes both mule deer and pronghorn crucial winter/yearlong range (Figure 3-14). It is estimated that 1 or 2 wells may occur within this area of crucial big game overlapping habitat, resulting in disturbance of 3.5 - 7 acres of habitat (0.5% - 1%).

Table 4-14. Summary of impacts (acres) on big game seasonal ranges with construction of the Proposed Action.

of the Proposed Action:										
Species Range Type	Area (ac)	Well Pads		Disposal Wells (ac)	Roads (ac)	Pipelines		Compres sor (ac)	Total (ac)	% ¹
		#	ac			Gathering (ac)	Delivery (ac)			
Mule Deer										
Crucial Winter Yearlong	7,648	21	23.1	2.5	25.2	25.2	10.7	0.9	87.6	1.1
Winter Yearlong	35,512	99	108.9	9.9	118.8	118.8	49.9	3.6	409.9	1.2
Totals	43,160	120	132	12.4	144	144	60.6	4.5	497.5	1.2
Elk										

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Yearlong	40,944	114	125.4	11.2	136.8	136.8	57.5	4.5	472.2	1.2
Out	1,834	6	6.6	1.2	7.2	7.2	3.1	0	25.3	1.4
Totals	43,160	120	132	12.4	144	144	60.6	4.5	497.5	1.2
Pronghorn										
Winter Yearlong	36,455	101	111.1	9.9	121.2	121.2	51.2	3.6	418.2	1.1
Crucial Winter/Yearlong	6,705	19	20.9	2.5	22.8	22.8	9.4	0.9	79.3	1.2
Totals	43,160	120	132	12.4	144	144	60.6	4.5	497.5	1.2

1 - Percentage of each type disturbed

4.7.1.1.3 Wild Horses

Surface disturbing activities associated with the construction of well pads, reserve pits, and roads could adversely affect wild horses. Land clearing and grading activities necessary for construction remove vegetation (i.e., result in loss of forage resources) and create disturbance by increased human activity. BLM standards for reclamation of disturbed sites, such as linear road and pipeline ROWs and well pad sites are adequate to mitigate any potential adverse effect on wild horses due to vegetation removal. Effects of the Proposed Action would be temporary, as the vegetative conditions on most sites are ultimately reclaimed and return to pre-existing levels.

All gates will be closed each time after opening. If fences are breached they would need to be repaired as quickly as possible.

The impact of project-related activities on forage production is shown in Table 4-13. The Proposed Action is estimated to initially reduce available Animal Unit Months (AUM's) by about 47.4 AUM's which represents about 0.02% of the total 193,780 AUM's permitted for the Rock Springs and Vermillion Creek grazing allotments (Lloyd 2004). During the estimated LOP, this total is estimated to decrease to about 14.6 AUM's which represents about 0.008% of the total permitted AUM's for the two allotments. The short-term impacts of vegetation disturbance and/or removal of wild horses due to project activities is anticipated to be minor because the maximum initial disturbed acreage (497.5 acres, Table 2-1) represents only 0.03 % of the total 1,946,321 acres within the Rock Springs and Vermillion Creek grazing allotments.

Preventing and containing the spread of noxious and invasive plant species would be a positive impact to wild horses (and wildlife/livestock) by reducing competition with native plants, consequently maximizing forage production.

Risk of displacement of wild horses from the PRPA to areas outside the HMA boundary is believed to be minimal due, in large part, to:

(1) Warren estimates that 1-3 years would be required to complete the project which provides a fairly wide-window of time for actual drilling activities, thus decreasing the potential concentration and number of drilling operations/vehicles/and people at any particular location, time or season, and;

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(2) Free-roaming wild horses in the Salt Wells HMA have demonstrated the innate capacity to disperse over wide areas in search of food and water, seek shelter, or to escape insect pests and human activity.

Primary public access to view wild horses on and near the project area is via WYO 430, Sweetwater County Road's 19, 4-24 and 4-26, and numerous access roads already present in the PRPA. The Proposed Action would not affect the opportunity for the public to view wild horses.

Indirect impacts of the proposed project on wild horses may result from increased human and vehicle activity that may increase the potential for horse/vehicle collisions. However, if Warren advises project personnel regarding appropriate speed limits on designated access roads as specified in Chapter 2, and these instructions are complied with, the likelihood of horse/vehicle collisions would be minimized. The wary nature of wild horses also decreases their likelihood of being struck by a vehicle. In addition, the wild horse population in the Salt Wells HMA is habituated with local vehicle traffic on the primary roads of the PRPA.

4.7.1.1.4 Upland Game Birds

Greater Sage Grouse. See Section 4.8.2.1.2.

Mourning Dove. Mourning doves are known to breed in areas west of the project area, and it is likely that some limited breeding activity and nesting occurs on the project area. The project area is located in UGMA #6, in which only 0.1% of the state's total harvest of mourning doves occurred in 2002 (WGFD 2003c). Mourning dove habitat on the project area is marginal in quality and disturbances that may occur are not expected to significantly impact this species.

4.7.1.1.4 Waterfowl and Shorebirds

Habitat for waterfowl and shorebirds is very limited on the project area. Given mitigation measures for water resources identified in this document and in the RMP, it is expected that the Proposed Action would not have significant impacts upon waterfowl or shorebirds.

4.7.1.1.5 Raptors

The potential impacts of the Proposed Action on raptors are: (1) nest abandonment and/or reproductive failure caused by project related disturbance, (2) increased public access and subsequent human disturbance resulting from new road construction, and (3) small, temporary reductions in prey populations.

The primary potential impact to raptors from project activities is disturbance during nesting that might result in reproductive failure. To minimize this potential, disturbance would not be allowed during the critical nesting season (Feb. 1 - July 31, depending on the species) near active raptor nests. The size of the restrictive radius and the timing restriction may be modified depending on species of raptor and whether or not the nest is within the line of site to construction activities. Nests may be considered active if they were used within the past three years. Records from the BLM Rock Springs Field Office and HWA show that 23 raptor nests occur on or within one mile of the PRPA (Figure 3-15). Activity status of raptor nests will be checked prior to well development. If new raptor nest sites are located on the project area in future years,

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appropriate avoidance and mitigation measures would be taken to avoid significant impacts to breeding raptors.

4.7.1.2 No Action Alternative

Impacts resulting from the implementation of this alternative would be similar to those described under the Proposed Action, but of a lesser magnitude. It is estimated that approximately 73.3 acres of general wildlife habitat would be disturbed under the No Action Alternative (see discussion in Section 2.3).

4.7.2 Mitigation

No additional mitigation is required.

4.7.3 Residual Impacts

Although the potential impacts associated with the Proposed Action would not be substantial, the effects of some would persist until they were off-set over time. Such effects would include the: (1) long-term loss of 27.1 and 24.8 acres of crucial winter range for mule deer and pronghorn, respectively, and (2) long-term reduction of potential sage-grouse nesting habitat. Construction of new roads may also cause long-term impacts such as increased human disturbance of wildlife near those roads and an increased potential for wildlife/vehicle collisions, poaching, and harassment.

4.8 SPECIAL STATUS WILDLIFE, FISH AND PLANT SPECIES

4.8.1 Threatened, Endangered, Candidate, or Proposed for Listing Species of Wildlife, Fish, and Plants

4.8.1.1 Proposed Action

The following species are either threatened, endangered, or proposed for listing under the ESA. These species may have potential to occur on or near the project area and therefore potential impacts to these species caused by the Proposed Action are considered.

4.8.1.1.1 Mammals

Black-footed Ferret. In Wyoming, white-tailed prairie dog colonies provide essential habitat for black-footed ferrets. Ferrets depend almost exclusively on prairie dogs for food, and they depend upon prairie dog burrows for shelter, parturition, and raising young (Hillman and Clark 1980). Prairie dog towns within the PRPA were mapped during the fall of 2003. Eighteen colonies, covering 3,612 acres, were surveyed for the presence of black-footed ferrets in September and October 2003 (HWA 2003a, b). All black-footed ferret surveys were performed in accordance with black-footed ferret survey guidelines outlined by the FWS (USDI-FWS 1989). No black-footed ferrets or their signs were observed during the nocturnal spotlight survey or morning ground search (HWA 2003a,b). Survey results and maps are available at the BLM RSFO.

On February 2, 2004, the U.S. Fish and Wildlife Service issued a notice that a block clearance, eliminating the need to conduct surveys for black-footed ferret surveys, was issued on many

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areas in Wyoming (USDI-FWS 2004). According to the notice, ferret surveys in those areas are no longer required and the take of individual ferrets and effects to wild populations are not expected to be an issue. However, this does not mean that those areas included in the block clearance are free of all value to black-footed ferrets. The PRPA is located within the area that has been cleared from the need for ferret surveys. Therefore, no further black-footed ferret surveys would be required within the PRPA. Where possible, project developments should avoid white-tailed prairie dog colonies, however disturbance of colonies would not impact black-footed ferrets. It is estimated that 37.3 acres of white-tailed prairie dog colonies would be disturbed under the Proposed Action. This constitutes only 1.1% of the white-tailed prairie dog colonies within the PRPA. This amount of disturbance to prairie dog colonies would be a minor impact and would not result in significant effects upon the value of the colonies as potential future reintroduction sites. No impacts to black-footed ferrets would occur provided avoidance and mitigation measures outlined in this document and the RMP are implemented.

4.8.1.1.2 Birds

Bald Eagle. Bald eagles typically build stick nests in the tops of large coniferous or deciduous trees along streams, rivers or lakes. This type of habitat is not present on the project area, therefore, bald eagles are not expected to nest there. Bald eagles may utilize the project area during winter months when big game species are more concentrated on winter ranges. However, the area does not support concentrated use by bald eagles and bald eagle use of the project area is likely incidental. Therefore, the Proposed Action is not expected to impact bald eagles. No effect.

Yellow-billed Cuckoo. Due to the lack of adequate habitat on the project area and the fact that no records of yellow-billed cuckoo are documented within six miles of the project area (WGFD 2003a, WYNDD 2003) it is unlikely that the yellow-billed cuckoo occurs on the project area. No adverse impacts to this species are expected from implementation of the Proposed Action.

4.8.1.1.3 Fish

The drainages in the project area are ephemeral or intermittent. Four federally endangered fish species may occur as downstream residents of the Colorado River system: bonytail chub (*Gila elegans*), Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), and razorback sucker (*Xyrauchen texanus*). However, these fish species are likely extirpated from the Colorado River system above Flaming Gorge Dam on the Green River (Baxter and Stone 1995). None of these four endangered fish species are likely to be found within the project area, nor has critical habitat been established in Wyoming for any of these species (Upper Colorado River Endangered Fish Recovery Program 2002). Produced water would be injected into water disposal wells, therefore, produced water is not expected to have any impacts upon the endangered species found downstream from the PRPA.

The primary concern with the Proposed Action related to Colorado River endangered fish is water depletion. It is estimated that 4,500 barrels of water would be needed to drill and complete each well; however, actual water volumes would be dependent upon the depth of the wells and any losses that might occur during the drilling and completion operations. For conservation purposes, water used to drill one well may also be reused for drilling subsequent wells. The maximum amount of water needed to develop the proposed wells under the Proposed Action would be approximately 69.6 acre-feet over the 2-4 year development period.

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Under the *Recovery and Implementation Program for Endangered Fish Species in the Upper Colorado River Basin* (RIP), “any water depletions from tributary waters within the Colorado River drainage are considered as jeopardizing the continued existence of these fish.” Tributary water is defined as water that contributes to instream flow habitat. Depletion is defined as water which would contribute to the river flow if not intercepted and removed from the system.

The FWS has determined that progress made under the RIP has been sufficient to merit a waiver of the mitigation fee for depletions of 100 acre-feet per year or less (Memorandum dated March 9, 1995 to Assistant Regional Director, Ecological Services, Region 6, from Regional Director 6, “Intra-Service Section 7 Consultation for Elimination of Fees for Water Depletions of 100 acre-feet or Less from the Upper Colorado River Basin”). The Proposed Action would deplete approximately 69.6 acre-feet of water during the 2-4 year development period, and thus a mitigation fee waiver would be applicable. Formal consultation with the FWS regarding Colorado River depletion will be requested for the Proposed Action. This minor level of water depletion would not result in impacts to the endangered fish found downstream of the PRPA.

4.8.1.1.4 Plants

No federally listed threatened, endangered, or candidate plant species are known to occur on the PRPA (Glennon 2004). Ute ladies'-tresses (*Spiranthes diluvialis*), an FWS threatened species, is known to occur in certain habitats along the Green River in Daggett County, Utah, south of the PRPA. Although no suitable habitat for Ute ladies'-tresses occurs on the PRPA, the proximity of known populations in Utah requires field surveys for the plant in Sweetwater County to meet FWS and ESA Section 7 requirements for Environmental Assessments (Glennon 2004). The likelihood of Ute ladies'-tresses occurring on the PRPA is extremely low and no impacts to this species are expected under the Proposed Action.

4.8.1.2 No Action Alternative

Impacts resulting from the implementation of this alternative would be similar to those described under the Proposed Action, but of a lesser magnitude. It is estimated that approximately 73.3 acres would initially be disturbed under the No Action Alternative (see discussion in Section 2.3), due to continuing gas-related activity, which represents about 0.2% of the PRPA. As site reclamation proceeds, the estimated LOP disturbance acres would be reduced from 73.3 acres to 25.8 acres which represents about 0.06% of the PRPA.

4.8.1.3 Mitigation

No additional mitigation is required.

4.8.1.4 Residual Impacts

No residual impacts are expected to occur with project implementation.

4.8.2 Sensitive Wildlife, Fish, and Plant Species

Although these species have no legal protection under the ESA, the BLM and FWS still maintain an active interest under BLM Manual 6840. The BLM treats these species as candidate species and takes actions to preclude the need for listing. All of these species may have the potential to

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occur on or near the project area and, therefore, potential impacts to them that may be caused by the proposed action, are considered.

4.8.2.1 Proposed Action

4.8.2.1.1 Mammals

Townsend's Big-eared Bat. Potential habitat for Townsend's big-eared bat does occur within the PRPA and it is possible that it may occur there. Bats are very mobile species and direct impacts upon individual bats are unlikely. The limited amount of suitable habitat for Townsend's big-eared bat that would be impacted under the Proposed Action would result in minor impacts to the species, if it occurs on the PRPA.

Swift Fox. Some portions of the project area may provide limited foraging and denning habitat, however, swift foxes are very adaptable, and the limited amount of disturbance would result in minor impacts to swift foxes, if they are present on the PRPA.

Wyoming Pocket Gopher. Potential habitat exists within the project area for Wyoming pocket gophers. There has been one documented occurrence of a Wyoming pocket gopher approximately ½ mile west of the PRPA (WYNDD 2003) and it is likely that this species occurs within the PRPA. This species utilizes dry ridge tops with dry gravelly soils and greasewood. This species may be abundant within its distribution, but no population studies have been conducted (Clark and Stromberg 1987). Avoidance of dry ridges with soil types preferred by Wyoming pocket gophers would minimize any impacts to this species. No significant impacts to this species are expected with development of the Proposed Action because habitat disturbance within the PRPA from development would be minimal.

Pygmy Rabbit. Pygmy rabbits are limited to areas of dense and tall big sagebrush (Campbell et al. 1982, Clark and Stromberg 1987, Heady et al. 2002). No pygmy rabbit records within six miles of the project area were documented in the WOS (WGFD 2003a) or the WYNDD (2003). The project area is primarily dominated by Wyoming big sagebrush and it is possible that pygmy rabbits could occur on the project area. RSFO wildlife biologists feel that the species may occur within the project area; therefore, stands of tall sagebrush should be avoided where possible to minimize any potential impacts (J. Dunder, 2004).

Approximately 387 acres of various sagebrush habitats would be disturbed under the Proposed Action. This loss of potential pygmy rabbit habitat could result in the direct mortality of some individuals and displace others into surrounding areas of lesser quality habitat, however it is unlikely the population would be significantly impacted because only 1.1% of the sagebrush habitat would be disturbed. If pygmy rabbits are found to occur on the project area, potential impacts to them could be reduced by avoiding well, road, and pipeline placement within areas of tall dense sagebrush.

4.8.2.1.2 Birds

Mountain Plover. No mountain plover records within the 6-mile buffer of the project area were reported in the WOS (WGFD 2003a) or WYNDD (WYNDD 2003). Areas providing potential mountain plover habitat were mapped from the ground by HWA in early September 2003. Potential mountain plover habitat closely corresponded to the extent of the white-tailed prairie dog colonies. A total of 4,670 acres of potential mountain plover habitat was mapped, of which,

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3,695 acres were located within the PRPA (Figure 3-17). No mountain plovers were observed on the PRPA during the surveys in the fall of 2003. A portion of the potential mountain plover habitat may be disturbed with implementation of the proposed action. Impacts to mountain plovers would be minimized by avoiding construction activities in suitable plover nesting habitat during the nesting period from April 10 - July 10, and/or avoiding surface disturbance within areas of potential mountain plover habitat the remainder of the year. The exact location of mountain plover nests may change annually, and mountain plover nest activity status and location must be kept current. For this reason, it is recommended that surveys for mountain plovers be conducted, within areas of potential habitat, prior to any surface disturbance in those areas, according to current mountain plover survey protocol (USDI-FWS 2002). No impacts to mountain plovers are expected provided that avoidance and mitigation measures outlined in this document and the RMP are implemented.

Greater Sage-Grouse. Suitable greater sage-grouse habitat is abundant on and around the project area and specific measures must be taken to avoid impacting this species. Sage grouse are of special concern because populations throughout the west have been declining and they have been petitioned for listing under the ESA. Just over three quarters of the PRPA (33,559 acres) supports a primary vegetation type dominated by one or more subspecies of sagebrush (see Section 3.5). Under the Proposed Action, approximately 194 acres of habitat located within two miles of active sage grouse leks (likely nesting areas) would be disturbed. This equates to approximately 0.6% of the available sagebrush habitat in the PRPA, or 3.6% of the likely nesting areas. Long-term disturbance would be reduced to approximately 60 acres. This amount of habitat disturbance is minimal (1.1% of likely nesting areas) considering the amount of sagebrush available in the project area (approximately 5,500 acres of likely nesting areas). Sage grouse may be impacted by other activities associated with development including increased human activity, increased traffic disturbance, and pumping noises. Sage grouse exhibit site fidelity to leks, winter areas, summer areas, and nesting areas (Eng 1963, Dunn and Braun 1985). Therefore, steps should be taken to ensure that impacts to these areas, especially leks and nesting areas, are minimized. Four active sage grouse leks have been identified on or within two miles of the project area (Figure 3-18).

Surface disturbance would be avoided within 1/4 mile of the three sage grouse leks within the project area boundary. Approximately 323.3 acres in the project area are located within the 1/4-mile buffer of those lek locations, on which no construction would be authorized except as authorized by exception (refer to 2.2.11.2.9). Construction activities within a two-mile radius of active leks would be restricted between March 1 and June 30 to provide protection for grouse during the egg-laying and incubation period. Exceptions may be granted if the activity will occur in unsuitable nesting habitat. If all avoidance and mitigation measures identified in this document and the RMP are implemented, impacts to greater sage-grouse are expected to be minimal.

Sage Thrasher. The sage thrasher is considered a sagebrush obligate and is generally dependent on large patches and expanses of sagebrush steppe for successful breeding. Suitable habitat for the sage thrasher occurs in the PRPA and the WGFD reported four records of sage thrashers occurring within six miles of the project area (WGFD 2003a). It is likely that sage thrashers use the larger patches of taller sagebrush within the project area. Development of the Proposed Action may displace some sage thrashers, however, suitable habitat is very abundant throughout the project area, and no significant impacts to this species are expected.

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Loggerhead Shrike. Three records of loggerhead shrikes are documented within six miles of the project area (WGFD 2003a) and it is likely that loggerhead shrikes utilize portions of the project area during the nesting season. This species uses thickly foliated trees and shrubs for nesting and roosting. Construction within this type of habitat may possibly disturb nesting shrikes. However, facilities associated with well development may provide increased perching sites, which shrikes use for hunting. Implementation of the Proposed Action is not likely to adversely affect the loggerhead shrike.

Brewer's Sparrow. Four records of Brewer's sparrows are documented within six miles of the project area (WGFD 2003a, WYNDD 2003). It is likely that Brewer's sparrows breed within the sagebrush habitats that exist on the project area. The Brewer's sparrow breeds in landscapes dominated by big sagebrush (*Artemisia tridentata*) throughout the Great Basin and intermountain West (Rotenberry et al. 1999). Development of the Proposed Action would likely displace some Brewer's sparrows, however, suitable habitat is very abundant throughout the project area, and therefore, no significant impacts to this species are expected.

Sage Sparrow. Sage sparrows typically utilize stands of big sagebrush or mixed big sagebrush and greasewood for nesting. One record of a sage sparrow was documented within six miles of the project area (WYNDD 2003). The project area is dominated by Wyoming big sagebrush and it is likely that sage sparrows occur on the project area. Because of the small amount of disturbance associated with the project, their inherent mobility, and the availability of suitable habitats on undisturbed land, the impact to sage sparrows under the Proposed Action is expected to be minimal.

Burrowing Owl. Burrowing owls typically utilize areas located in active prairie dog towns where burrows are readily available (Butts 1973). Two burrowing owl sightings have been documented within six miles of the project area (WGFD 2003a, WYNDD 2003) and HWA biologists observed burrowing owls at two locations within the PRPA in September 2003. The extensive white-tailed prairie dog colonies within the PRPA provide adequate nesting habitat for burrowing owls. If nesting owls are found on the PRPA during future raptor nest surveys, the same measures used for protection of other nesting raptor species would be applied. Given these precautionary measures, no adverse impacts to burrowing owls are expected to result from implementation of the Proposed Action.

4.8.2.1.3 Reptiles

Midget-faded Rattlesnake. The documented distribution of the midget-faded rattlesnake in Wyoming is west and south of the PRPA. However, the full extent of its range is not well known and the snake could potentially occur, although it is unlikely because of the lack of suitable habitat. Implementation of the Proposed Action is not expected to significantly impact midget-faded rattlesnakes if present.

4.8.2.1.4 Amphibians

Great Basin Spadefoot Toad. One record of a Great Basin spadefoot toad was documented in 1945, approximately seven miles east of the PRPA (WYNDD 2003). Although limited habitat exists in the PRPA, it is possible that Great Basin spadefoots may occur on the project area, where they may utilize intermittent and temporary water sources for breeding during years with adequate moisture. If the measures outlined in this document and the RMP are taken to avoid

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disturbance of water sources, no adverse impacts to this species are expected from implementation of the Proposed Action.

4.8.2.1.5 Fish

All of the streams within the PRPA are ephemeral and, therefore, do not have the potential to support sensitive fish species, listed by the BLM in Wyoming, on a year-round basis. However, three sensitive fish species are known to occur in streams downstream of the PRPA. These include the roundtail chub, bluehead sucker, and flannelmouth sucker (WYNDD 2003, USDI-BLM 2002). All three species are present in the Green River downstream of the PRPA, while the bluehead sucker and flannelmouth sucker have been collected in Bitter Creek (WGFD 2004). WGFD is entering into a cooperative agreement with other states where these three non-game species are present. The goal of the cooperative agreement is to manage these species to prevent them becoming threatened or endangered. All water produced from productive wells would be disposed of in water disposal wells, therefore, project activities should not affect these fish species of concern found downstream from the PRPA. If all other mitigation measures for soils and water resources in this document are implemented, no significant impacts to the sensitive fish species found downstream of the PRPA are expected.

4.8.2.1.6 Plants

The potential for disturbing plant species of special concern (Table 3-7) on the PRPA is minimal. As stated in Chapter 3, no federally listed threatened, endangered, or candidate plant species are known to occur on the project area, therefore there would be no impacts to these species. The nearest BLM sensitive species (Nelson's milkvetch) population is located about 10 miles from the project area. Wyoming tansymustard has been found closer than 1 mile from the project area, however, its habitat is located on steep slopes that should be avoided per BLM's standard stipulations (Glennon 2004). Potential impacts to plant species of special concern would be minimized assuming construction, maintenance and operation of well pad sites and associated disturbances are in accordance with Chapter 2 of this EA, Warren's APDs stipulations, and FWS/BLM requirements.

4.8.2.2 No Action Alternative

Impacts resulting from the implementation of this alternative would be similar to those described under the Proposed Action, but of a lesser magnitude. It is estimated that approximately 73.3 acres would initially be disturbed under the No Action Alternative (see discussion in Section 2.3), due to continuing gas-related activity, which represents about 0.2% of the PRPA. As site reclamation proceeds, the estimated LOP disturbance acres would be reduced from 73.3 acres to 25.8 acres which represents about 0.06% of the PRPA.

4.8.2.3 Mitigation

No additional mitigation is required.

4.8.2.4 Residual Impacts

No residual impacts are expected to occur with project implementation.

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4.9 RECREATION

The study area for recreation resources is the Pacific Rim Shallow Gas Project Area (PRPA), which is part of the 3.5 million acre Rock Springs Field Office. The PRPA contains no developed recreation sites or facilities, areas identified for dedicated use of off-highway vehicles (OHV) or unique recreation resource areas. The area does contain operating natural gas wells developed since 1954 and new gas facilities from Warren's exploratory shallow gas development begun in 2003.

4.9.1 Direct and Indirect Impacts

The Cherokee Trail corridor, which attracts some recreation use, is a mile-and-a-half south of the PRPA boundary and would not be subject to direct effects of the Proposed Action or alternatives. Potential visual impacts to the Cherokee Trail setting are discussed in Section 4.10, Visual Resources.

Dispersed recreation does occur within the PRPA on BLM-administered land, though almost the only recreational use of the area by residents and visitors is big and small game hunting and some pleasure driving for wild horse viewing. Camping and use of OHV that do occur are almost entirely to support hunting.

Under the GRRMP, the recreation management emphasis for the area is continued availability of outdoor recreational opportunities. This is to be accomplished while protecting other resources, meeting health and safety requirements for visitors and mitigating conflict between recreation and other resource uses (USDI-BLM 1997). The proposed action would not conflict with Sweetwater County's policy of protecting unique recreation resources (Sweetwater County 2002), which are absent in the PRPA.

Therefore, the recreation analysis focuses on the issue of displacement of existing, dispersed recreational use by the Proposed Action and alternatives. Impacts to recreation would be significant if the Proposed Action or alternatives were to lead to displacement of dispersed recreation use and if no other area can reasonably provide substitute resources for the displaced recreational activity. The dispersed recreation activities of concern are hunting and wild horse viewing.

4.9.1.1 Proposed Action

The principal reason for displacement of hunting is prolonged displacement of game populations and interference with hunters by project activity, vehicles and equipment. The potential for disturbance by human activity would be greatest during the construction and drilling phase of the Proposed Action when 120 wells would be developed over one to three years at an average spacing of four wells per square mile. These effects would be limited by the implementation of the operator-committed mitigation activities concerning recreation, namely posting warning signs, safety training for equipment operators, requiring adherence to low speed limits and monitoring recreation use of roads, especially during hunting seasons.

Although the construction and drilling phase of the Proposed Action could last up to three years, drilling and completing individual wells would last about two weeks each. Therefore, the disruption of hunting activities associated with the drilling and construction phase of would be

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localized and relatively short term. After drilling and construction, the level of human activity would be reduced for the life of the project to the low level associated with production.

Implementation of the Proposed Action would result in an additional 456 acres of surface disturbance on public land during the construction and drilling phase. Partial reclamation of well sites after completion would reduce the total surface disturbance to 138 acres for the life of the project. As noted in the wildlife section of Chapter 4, the disturbance of these acreages during each phase of the Proposed Action would have a low impact on game populations in the PRPA. The amount of land disturbed during each phase also is small in comparison to the total area that provides habitat for the game populations found in the area (see discussions in Section 4.7 for further details).

Human activity and surface disturbance may affect wild horse populations in the area as well, although herds are often seen in proximity to existing gas development in and near the PRPA. Potential effects to viewing of wild horses would be concentrated along primary roads that access the project area, namely WYO 430, SCR 19, SCR 24 and SCR 76, and SCR 77, which also may be used by pleasure drivers.

The analysis indicates that impacts to dispersed recreation in the PRPA would be low and well below the threshold of significance. Some displacement of hunters may occur from areas directly involved in construction and drilling to inactive areas, but the displacement would be temporary as rigs and crews move from site to site over the course of the construction and drilling phase. Minimal disturbance to game populations would occur over the life of project from land remaining disturbed for producing wells, roads and facilities.

The total potential for game habitat to be disturbed by drilling and construction or by production during the Proposed Action would be small compared to the total area of habitat used by game populations in the area. Conflict with recreation traffic would be mitigated by operator-committed activities in the area of traffic control, safety training and monitoring of recreation use of roads during hunting season.

Impacts to wild horse viewing would be low to negligible because the human activity impact is low, surface disturbance is low, and the sensitivity of the wild horse population to these effects is low (see Section 4.7.1.1.3 for further detail).

In addition, new roads developed in the PRPA to support gas development may facilitate access by hunters and wildlife viewers. This would enhance recreation opportunities to some degree in the project area.

4.9.1.2 No Action Alternative

Under the No Action Alternative, development of 108 wells on federal land would be disallowed. However, 12 wells would be drilled on private and state land, so federal land would be disturbed for new roads and pipelines to access those wells. The new roads and pipeline corridors associated with the No Action Alternative would affect hunting and wild horse viewing in ways that are similar in kind to the effects of the Proposed Action but that occur at just a small fraction of the magnitude. Therefore, impacts to dispersed recreation would be low if not negligible under the No Action Alternative.

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4.9.2 Mitigation Measures

No additional mitigation measures are necessary.

4.9.3 Residual Impacts

As noted, effects to typical dispersed recreation activities in the PRPA (hunting and wild horse viewing) could exist to at a low if not negligible level during both the construction and drilling and the production phases of the Proposed Action and the No Action Alternative. Though very small, these residual effects would exist even after the implementation of operator-committed mitigation activities concerning recreation resources in the project area.

4.10 VISUAL RESOURCES

4.10.1 Direct and Indirect Impacts

Modification of the landscape from grazing activity is apparent in the PRPA, as described in Chapter 3. Areas of disturbance from operating natural gas wells developed since 1954 are also visible from many viewpoints. Highly disturbed areas from Warren's exploratory development begun in 2003 are visible from SCR 76 and from resource roads in Section 31, Township 15, Range 101. In addition, as described in Chapter 3, the trail setting for segments of the Cherokee Trail south of the PRPA boundary extends into the PRPA.

Therefore, issues related to visual resources would include 1) increases in the extent or scale of visible gas development disturbances in the PRPA, 2) the appearance of project facilities in the PRPA during operations and production and at full reclamation and 3) the procedure for assessing as yet unspecified facilities that may be located within the Cherokee Trail setting during project development.

The analysis of visual impacts to the PRPA reflects guidance from BLM Handbook H-8431-1, Visual Contrast Rating (USDI-BLM n.d. [a]). Briefly, the analysis assesses the degree of visual contrast between the existing landscape character and condition with the character and condition predicted to occur from project development. The level of visual contrast is compared to visual management guidelines for the area, as determined by the visual resource management class designation. The assessment evaluates the compatibility of the development with the management class designation.

Criteria used to judge the significance of the visual impacts to the PRPA are:

- Significant—Predicted visual contrast that exceeds the visual resource management class guidelines,
- Moderate—Predicted visual contrast that is fully at the level of change allowed without exceeding management guidelines, and
- Low—Predicted visual contrast that is clearly below thresholds for visual change allowable by the management classification.

As noted in Chapter 3, all segments of the Cherokee Trail near the PRPA are being managed temporarily as eligible for inclusion in the National Historic Trails system, even though a

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determination has not been made as to the eligibility of any of these segments. Under the existing GRRMP management objectives for trails with historic status include protection of landscape quality in areas comprising the visual setting and contributing to a trail segment's historical and cultural character.

The agency would undertake a case-by-case review of project facilities in the setting of the Cherokee Trail near the PRPA. Review would be triggered by applications for permits to drill or by right-of-way applications for individual project components. Details on defining the trail setting and on review procedures are described later in the section.

4.10.1.1 Proposed Action

As noted in Chapter 3, all public lands within the PRPA are in VRM Class IV. Approved development on VRM Class IV lands may result in major modification of the landscape character (USDI-BLM 1997). This allows a strong level of contrast to remain after new facilities are designed and located to reduce contrast with the affected landscape. In addition, the potentially affected landscape in the PRPA includes visible disturbance from scattered producing and shut in wells developed since 1954.

More recently, exploratory development since 2003 indicates the level of contrast to be expected during the development period in the northern Pacific Isle unit below the Rife's Rim escarpment. About 52 acres of initial disturbance from wells and facilities in Warren's exploratory "pod" is visible from resource roads east of WYO 430 near the intersection with SCR 76.

As development in this area indicates, gas facilities designed and sited specifically for broken country with scattered pinon and juniper cover still produce a strong level of residual contrast with the surroundings. In this part of the PRPA, contrasts would usually be visible at relatively short distances because of the potential for intervening terrain features and vegetation. Development in this area also would be visible in the background from accessible parts of Kinney Rim, especially Pine Butte. Middle ground views from the lip of Rife's Rim would be possible, but much of the rim is relatively inaccessible.

Development in the rest of the PRPA, mainly the rolling, brushy slope radiating outward from Rife's Rim, also is predicted to create a strong level of residual contrast after use of design and location strategies. These visual disturbances would usually be seen in the middle ground to background from viewpoints such as CR 19, Pine Butte and Kinney Rim.

Adding 120 new wells and related facilities under the Proposed Action, including 108 on federal land, would greatly intensify the visual impact of gas development in the PRPA. Visual effects would be most evident during the two to four-year drilling and field development phase of the project when drilling rigs and construction equipment would be commonly seen and disturbance for well pads and linear facilities would be relatively fresh. During operation, as drilling and field development is completed and disturbed areas are partially reclaimed, visual impacts would become less evident. After the life of the project from 10 to 20 years after the start of development, all disturbed areas would be reclaimed and the remaining visual contrast would become low after revegetated areas become established and mature.

Operator-committed mitigation activities, such as the use of design and screening strategies, would reduce the visibility of facilities to potential viewers and lower the contrast with the surrounding landscape. These are described in Section 2.2.11.2.11. The adverse effect of

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strong contrasts created by the development is also moderated by the relatively low sensitivities in the viewshed, which encompasses lightly traveled county roads and distant overlooks like Pine Butte.

In the short term (during development), adverse visual impacts would be moderate because introducing strong visual contrasts into the landscape is allowable in VRM Class IV. In the long term (during operations and after the life of the project), adverse visual impacts would be moderate to low because part of the disturbed area would be reclaimed after the development phase and all remaining disturbed areas would be reclaimed after the life of project.

4.10.1.1.1 Cherokee Trail

As noted, management objectives expressed in the GRRMP for trails with historic status include protecting landscape within the visual horizon. In the case of the Cherokee Trail, the route is being managed temporarily as eligible for inclusion in the National Historic Trails system, pending legislation and final determination of the contributing segments.

The visual setting, or horizon, for Cherokee Trail segments near the PRPA is the landscape that can be seen from the trail's general route. For this assessment, the visual horizon has been delineated, through analysis of computer maps, for areas within five miles of the route. The defined area resulting from this analysis overlaps approximately 8.5 square miles in the southwest corner of the PRPA.

For facilities within the visual horizon, the BLM may require Warren to apply additional measures to reduce, eliminate or mitigate adverse visual effects to the trail setting. The BLM would undertake a case review when Warren submits an APD or right-of-way application for a specific facilities location.

Once a site is specified, overlaying the proposed site map with the map of the Cherokee Trail's visual horizon would identify facilities at risk of adversely affecting the trail setting. Based on the map identification, the BLM would physically inspect the site to verify the potential for an adverse effect, based on visibility of the facility from the trail route and whether unmapped changes on the ground may have rendered the question of impact moot.

If a visual impact were possible from the proposed site, the BLM would initiate a process to determine if the segment possesses features that contribute to the trail's national historic significance. Examples may include trail traces (ruts), monuments or other physical evidence of the past. The determination would be made in consultation with the State Historic Preservation Office (SHPO) and other interested parties, such as the Oregon-California Trails Association (OCTA).

If the segment is determined to be a contributing segment, the operator may be required to apply management practices, similar in kind to those already committed to, to meet a higher visual quality standard than VRM Class IV. The level of mitigation required to approve the facility would be determined by the BLM in consultation with the SHPO and OCTA.

Given that the operator has not specified sites for facilities at this time, the BLM will rely on a case-by-case consultation, established best management practices and experience with similar development to avoid significant adverse effects through the imposition of conditions to permits for well sites and rights-of-way for other facilities.

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4.10.1.2 No Action Alternative

Under the No Action Alternative, development of 108 wells on federal land would be disallowed. However, 12 wells would be drilled on private and state land, so federal land would be disturbed for new roads and pipelines to access those wells. The new roads and pipeline corridors would introduce strong contrasts into the federally controlled landscape. However, the total amount of disturbance would be low in comparison to the Proposed Action. Operator-committed mitigation activities that could screen new roads and pipeline corridors from view also would be used to limit impacts under the No Action Alternative.

4.10.2. Mitigation

No additional mitigation measures are necessary.

4.10.3 Residual Impacts

As noted, visual contrasts from wellhead facilities, ancillary facilities and access roads would be visible for the life of the project, even with the use of operator-committed mitigation activities. However, the level of contrast introduced by the disturbance is allowable in VRM Class IV.

4.11 CULTURAL RESOURCES

4.11.1 Direct and Indirect Impacts

4.11.1.1 Proposed Action

Cultural resources on public lands, including archaeological sites and historic properties, are protected by various laws and regulations, for example the National Historic Preservation Act of 1966 (NHPA) and 36 CFR 800. The specific directives can be found in "Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines" (Federal Register 1983). Laws and regulations concerning cultural resources stipulate the proposed undertaking take into consideration the effects of the action to significant cultural resources. This requires that cultural resources within the proposed area of potential effect (APE) must be identified and evaluated. Measures will be taken to mitigate or minimize adverse effects to historic properties included in, or eligible for, the NRHP.

The PRPA data base contains 76 sites. Of the recorded 76 sites, 33% are recommended eligible for nomination to the NRHP, 6.5% are eligible with SHPO concurrence, 11.8% are recommended not eligible for nomination to the NRHP, 5.3% are not eligible with SHPO concurrence, and 43.4% remain unevaluated. Of the total site types, 79% are prehistoric sites, 11.8% are historic sites, 6.6% are structures, and 2.6% contain both prehistoric and historic components. Prehistoric sites include camps consisting of habitation sites and lithic scatters. The prehistoric lithic debris sites are categorized as lithic scatters, quarry sites, primary and secondary procurement sites. Prehistoric/historic rock alignments, cairns, and rock shelters are documented in the study area. Only two prehistoric/historic sites are documented in the study area. The historic sites include a cabin, a windmill, and two debris sites including a ranching/stock herding debris site.

Potential impacts to specific eligible or unevaluated properties are unknown at this time. Only 22 projects have been conducted in the Pacific Rim study project area. The PRPA

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encompasses approximately 74.4 square miles or 47,597.82 acres. Approximately 1372 acres (block) or cumulative area 2.9% of the analysis area have been inventoried at Class III level for an approximate site density of less than one site per acre. The overall site density within the PRPA varies with the highest number of sites located along ridge slopes, in eolian deposits, and near the major topographic land forms. Certain topographic settings have a higher archaeological sensitivity such as eolian deposits (sand dunes, sand shadows, and sand sheets), alluvial deposits along major drainages, and colluvial deposits along lower slopes of ridges.

Mitigation of potential adverse effects is granted to National Register listed sites and sites identified as significant and eligible for nomination to the National Register. Significance is measured by four categories defined by the National Register (36 CFR 60.4):

“the quality of significance in American history, architecture, archaeology, and culture present in districts, sites, buildings, structures and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association; and that:

- are associated with events that have made a significant contribution to the broad patterns of our history; or
- are associated with the lives of persons significant in our past; or
- embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- have yielded, or may be likely to yield information important in prehistory or history.”

For archaeological sites, both prehistoric and/or historic, significance is primarily judged by the site's ability or potential to yield information important in prehistory or history. In other words, significance is based on it's information content and how that information will contribute to addressing local and regional questions, topics, and problems that are germane to the study area are detailed below. The cultural resources within the PRPA can be evaluated with reference to these research objectives.

Advisory Council regulations for Historic Preservation (36 CFR 800.9) are used by the BLM to assess effects to sites deemed eligible for nomination to the National Register. Adverse effects:

- Destruction or alteration of all or part of a property.
- Isolation of a cultural resource from, or alteration of, its surrounding environment.
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting.
- Neglect and subsequent deterioration.

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Adverse effects could be in the form of direct, indirect, or cumulative impacts. Direct impacts would primarily result from construction related activities and would be considered significant if lost information impeded efforts to reconstruct the prehistory or history of the region. Activities considered to have the greatest effect on cultural resources include blading of well pads and associated facilities, and the construction of roads and pipelines. Sites located outside the APE will not be directly affected by the construction activities. If the area of the site crossed by earth disturbing activities does not possess the qualities that contribute to the eligibility of the site, the project is judged to have no effect. Mitigation is the response for those sites that fall within the APE resulting in the loss of significant information. Alteration of the environment abutting eligible historic properties (recommended under Criteria a, b, or c) may be considered an adverse effect in the form of a direct impact.

Indirect impacts would not immediately result in the physical alteration of the property. Indirect impacts to prehistoric sites primarily would result from unauthorized surface collecting of artifacts which could physically alter the sites. At historic sites this could include bottle collecting and the introduction of visual impacts.

Contributing segments of historic trails will be avoided by a ¼ mile buffer zone or within the visual horizon, whichever is closer. These actions are designed to provide protection for the historic trail corridors.

4.11.1.2 No Action Alternative

Impacts to prehistoric and historic properties under the No Action Alternative would be similar to Proposed Action but of a lesser magnitude. These impacts are expected to increase on private surfaces under this alternative.

4.11.2 Impacts Summary

Gauging the effect of any impact depends on the level of information available for that particular property provided by inventory and/or testing data. If cultural resources on or eligible to the National Register are to be adversely impacted by the proposed undertaking, then the applicant, in consultation with the surface managing agency and the SHPO, shall develop a mitigation plan. Construction would not proceed until terms of the mitigation plan are satisfied.

4.11.3 Mitigation

Mitigation procedures will be implemented if a site considered eligible (under “Criterion d” only) or listed on the National Register is impacted. Avoidance is preferred and is achieved through redesign of a project, elimination of the project, or minimizing impacts. However, these means are not always possible. Mitigation of adverse effects to properties would be accomplished by the documentation of physical remains. Mitigation would include data recovery of prehistoric and historic sites and could include documentation through detailed drawings and photographs of standing structures. Data recovery plans are subject to review and approval by the BLM, SHPO, and the Advisory Council on Historic Preservation.

4.11.4 Residual impacts

Avoidance of known significant cultural resources during the construction projects and implementation of Class III cultural resource inventories for the proposed actions minimizes the

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potential for adverse impacts to cultural resources. Implementation of protective measures on all lands would result in the avoidance of impacts to cultural resources in the Pacific Rim EA area.

4.12 SOCIOECONOMICS

The study area for potential socioeconomic effects of the Proposed Action and alternatives includes Sweetwater County and the City of Rock Springs.

4.12.1 Direct and Indirect Impacts

4.12.1.1 Proposed Action

The Proposed Action would enhance regional economic conditions and generate local, state and federal government tax and royalty revenues. The relatively small, short-term drilling and field development workforce, whether locally or non-locally hired, could add to the overall growth and service demand that Sweetwater County and Rock Springs experienced during 2003, depending on the level of gas development that is occurring at the time that drilling and field development activity occurs.

Economic and Employment Effects

Development and operation of the Proposed Action would require goods and services from a variety of local and regional contractors and vendors, from the oil and gas service industry, the construction industry and from other industries. Expenditures by the Operators for these goods and services, coupled with employee and contractor spending, would generate both direct and indirect economic effects in southwest Wyoming, elsewhere in the State of Wyoming and in the nation as a whole.

Direct employment effects of the development phase of the Proposed Action would involve contractors and contract employees, for well drilling and completion, pipeline and power line construction, access road and well pad construction, and compressor and generator construction services. These services are available locally, in Rock Springs and other Sweetwater County communities, and regionally, in Casper, Gillette and other Wyoming communities, as well as in nearby locations in Colorado and Utah.

Drilling contractors will be required on a temporary, short-term basis for about six or seven months of each year or less, depending on wildlife restrictions and weather conditions. Completion and other field development contractors would be required temporarily, for a matter of weeks or days, for the duration of a particular task. It is likely that both local and non-local contractors would be hired for the project, depending on such factors as availability, cost and expertise. Locally hired contractors and employees would generate different socioeconomic effects than non-local contractors, who would relocate to the area for the duration of their particular task.

As discussed in Section 2.2.2.3, it is anticipated that two drilling rigs would be operating on-site, and that 10 to 15 workers would be on location at a drill site at any one time, depending on the function being performed (site preparation, drilling, completing, well logging, etc). Including road, gathering system, power line, compression and generation facility construction, on site

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employment would average an estimated 42 workers per day during the six to seven month annual drilling period.

During project operations, only one or two fulltime employees in Sweetwater County would be required. The field would require routine maintenance, which would be performed by contractors, and each well would require workover operations every several years, during which time a crew of 4 or 5 contract workers would work at the well for a variable number of days, depending on the workover activities required at each well.

The Proposed Action as described in Chapter 2 of this assessment would involve an estimated \$77 million capital investment in natural gas wells. The University of Wyoming Agricultural Economics Department has recently performed economic analyses for the Pinedale and Rawlins Resource Management Plans (Taylor 2004). These analyses estimated employment, earnings and total economic activity associated with natural gas drilling and completion activities for a variety of well types in the Pinedale and Rawlins Resource areas. In order to estimate the economic and employment effects of the Proposed Action, the total economic impact, employment and earnings coefficients for similar wells in the Pinedale and Rawlins areas were averaged and adjusted for estimated Pacific Rim drilling and completion costs. Based on these averages and adjustments, it is estimated that each of the 120 shallow gas wells associated with the Proposed Action would generate \$692,000 in total economic impact, \$165,000 in total earnings and 5.2 direct and indirect annual job equivalents. Each injection well would generate an estimated \$1.2 million in total economic activity, 9 annual job equivalents and \$285,700 in earnings. All estimates are in 2000 dollars. Annual job equivalents, henceforth called jobs, represent the jobs and portions of jobs totaling one full-time job that would be created by the Proposed Action as well as existing jobs and portions of existing jobs that would be supported in whole or in part by the Proposed Action. These jobs may be direct jobs, created in industries that work in or support gas development or production, or indirect jobs, created in industries supported by Operator, employee and contractor spending and successive rounds of re-spending in southwest Wyoming.

In all, the 120-well drilling phase of the Proposed Action would generate an estimated \$95.4 million in total economic impact, \$22.6 million in total earnings and 714 direct and indirect jobs. Divided over the three year drilling phase assumed for the socioeconomic assessment, employment would be an estimated 238 direct and indirect jobs per year. The direct employment effects would occur during the six to seven month annual drilling period and include the on-site average of 42 employees discussed above. The 238 jobs represents less than one percent of total 2001 Sweetwater County employment. Note that the local economy may be able to accommodate this additional employment and income with existing capacity therefore, the above employment estimates represent the maximum employment impact of the Proposed Action.

The UW analyses prepared for the Pinedale and Rawlins RMPs also estimated the economic effects associated with 1,000 MCF of natural gas produced in southwest Wyoming at an average sales price of \$3.25/MCF. These estimates included an average of \$3,919 in total economic impact in southwest Wyoming, \$197.50 in earnings and .0052 jobs.

The Operators anticipate that the wells associated with the Proposed Action would produce an estimated 170,689 MMCF over 22 years. Based on the UW estimates, the 120 wells associated with the Proposed Action would generate an estimated \$669 million in total economic impact in southwest Wyoming over 22 years, or an average annual economic impact of \$30.4 million.

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This would include estimated total earnings of \$33.7 million (an annual average of \$1.5 million), associated with an annual average of 40 direct and indirect jobs. As with drilling, these 40 jobs would represent both existing and new jobs and portions of jobs across a number of industries, located in a number of southwestern Wyoming communities.

The foregoing assessment assumes that all wells would be successful. If some wells were dry, if production were less than anticipated, or if gas prices were lower than prices assumed for this assessment, the economic effects of the project would be lower than those presented above. Conversely, higher rates of production and/or gas sales prices would produce higher economic effects. Note that nationally, gas wellhead prices averaged an estimated \$5.22/MCF for the first quarter of 2004 (EIA 2004) and year-to-date prices at Wyoming hubs averaged \$4.58 MCF (CREG 2004). Nationally, gas prices ranged from \$2.19/MCF to \$4.98 MCF between 1999 and 2003 (EIA 2004).

Sweetwater County Oil and Gas Activity

Gas production associated with the Proposed Action would represent a small portion of recent Sweetwater County production. Based on operator production forecasts, annual production would begin at 1,456 MMCF in 2005. Peak year production would occur in 2010 at 18,928 MMCF, which is about eight percent of total 2003 Sweetwater County natural gas production.

Assuming that the 120 wells associated with the Proposed Action were drilled in three years, the annual increment in drilling would equal about 6 percent of all Sweetwater County APD applications in 2003. According to WOGCC statistics approved drilling permits issued for Sweetwater County during the first six months of 2004 total 235, a 25 percent reduction in the level of permits approved in the first six months of 2003.

Population Effects

Direct and indirect population effects of the Proposed Action would be minimal, but would contribute to the overall natural gas-related employment and population levels in Sweetwater County and the City of Rock Springs. As noted above, the pace of drilling in Sweetwater County appears to be slowing in 2004, therefore the existing Sweetwater County workforce may be able to accommodate the direct and indirect employment demand associated with the Proposed Action. However, natural gas drilling levels are volatile, and the ability of the Sweetwater County workforce to accommodate the Proposed Action would depend on the overall level of drilling activity in Southwest Wyoming at the time the Proposed Action is implemented.

Drilling and field development activities associated with the Proposed Action would occur during six to seven months each year for two to four years; however, three years was assumed for the socioeconomic assessment. Drilling, completion and field development activities would be performed by contractors, who would come from Rock Springs, from elsewhere in Wyoming or from out of state. Non-local contractors and their employees would be likely to locate to Sweetwater County temporarily, for the duration of their contract. Due to the intermittent and temporary nature of the drilling and field development phase of the project, non-local workers are likely to relocate to Sweetwater County single status, and return to their place of residence on their days-off and during periods when drilling ceases. This assumption appears to be collaborated by the recent experience of Sweetwater County School District #1 (Rock Springs),

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which has experienced continuing declines in enrollment over the past year, a period when natural gas-related activity has increased substantially (Strahorn 2003).

The UW model estimates that a total of 238 direct jobs would be associated with the three year drilling and field development phase of the project. For the purpose of this assessment, it was assumed that 50 percent of these jobs represent currently employed workers who would retain existing employment based on the project-related economic activity. Of the assumed 119 who would relocate to the area, an estimated 40 percent would be single status. It is also assumed that each household would average 2.5 total persons and 1.25 employed persons. These latter two values are Wyoming statewide averages from the 2000 census. These estimates and assumptions would yield a total population of 183 persons during the three year drilling phase assumed for the socioeconomic assessment. This population would be likely distributed across several southwestern Wyoming communities but concentrated in Rock Springs. The total 183 persons would be just under one percent of total 2003 Rock Springs population.

The estimated 40 direct and indirect jobs associated with project operations would similarly reflect existing and new employees in several southwestern Wyoming communities and generate negligible population effects for any one community. Similarly assuming that half of these workers would be workers who retain existing jobs, but because production economic effects are long term, none would be single status, the total population effect would be 40 persons, assuming the statewide average household sizes and employees per household ratios identified above.

Although population effects for the Proposed Action would be minimal, they must be considered in the context of overall natural gas related growth in Sweetwater County. Section 4.12.4 discusses cumulative population growth in the county.

Housing Demand

As described in Section 3.12, there is little availability in either temporary or long-term housing resources in Rock Springs, as a result in the recent surge in natural gas activity. Locally-hired resident drilling and field development workers would already have housing, but non-local workers may have difficulty obtaining longer-term housing resources such as apartments or motels that rent by the week or month. Total housing demand associated with the non-local portion of the Proposed Action-related drilling and field development population (direct and indirect) would be 73 units. There are available mobile home spaces and rooms in more expensive daily-rate motels to fill this demand until workers would be able to find long term housing. Drilling and field development contractors may be required to supply mobile homes for employees or provide higher per diem allowances, depending on the level of natural gas activity at the time Proposed Action-related drilling and field development activity occurs.

The operations phase of the Proposed Action would generate demand for an estimated 16 housing units. These individuals would currently have a difficult time obtaining housing in Rock Springs, although, as discussed above there is some mobile home pad availability in mobile home parks.

Community Facilities, Law Enforcement and Emergency Response Demand

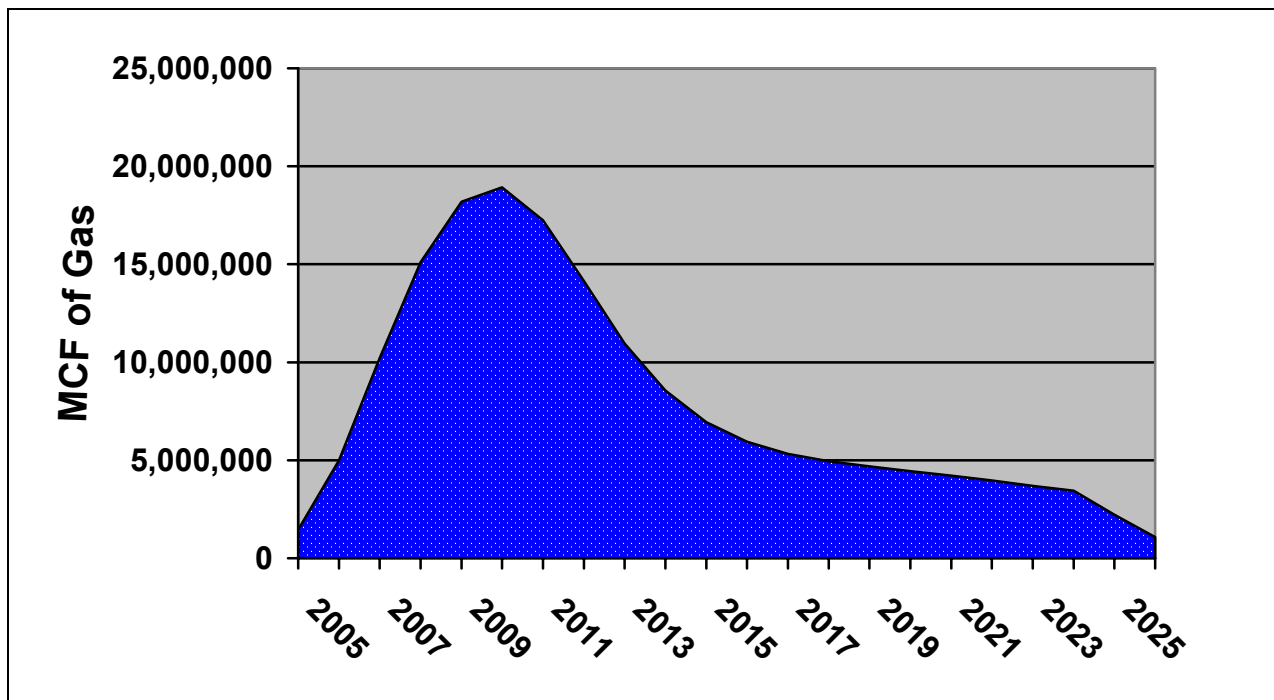
As described in Section 3.12, most community infrastructure in Sweetwater County and Rock Springs has been sized to serve a larger population than currently exists. Two notable

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exceptions are the Sweetwater County Jail (a new jail is under construction) and the Rock Springs sewage treatment facility, which is currently at capacity. The recent surge in natural gas development activity has caused the City of Rock Springs to accelerate plans to expand sewage treatment capacity (Walker 2004). The temporary, short-term employment and population associated with the Proposed Action would contribute to the cumulative sewage treatment demand (see Section 5.12) but that contribution would be minimal and short term. The population increase associated project operations and the secondary employment effects of increased natural gas production would contribute to the longer term demand for sewage treatment facilities, but would be a relatively small portion of overall demand.

County and Rock Springs municipal services such as law enforcement and human services are experiencing increased demand, related primarily to the cumulative surge in natural gas drilling and field development activity (Gordon 2004, Kot 2004, Lowell 2004, Scofield 2004, Vess 2004). The employment and population associated with the development phase of the Proposed Action would contribute to that demand, although the contribution would be relatively minor, temporary and short-term. Service demand associated with the field operations and indirect employment associated with the Proposed Action would be longer-term, but relatively minor and a small portion of overall service demand. Cumulative gas industry effects on community facilities and services are discussed in Section 4.12.4.

Figure 4-2. Estimated Annual Proposed Action-Related Natural Gas Production



Sources: Warren E&P, Blankenship Consulting LLC

Fiscal Effects

The Proposed Action would generate state and local tax revenues including:

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- ad valorem property taxes;
- sales and uses taxes to the State of Wyoming, Sweetwater County and its incorporated municipalities;
- mineral royalties to the federal government, a portion of which are returned to the State and local governments; and,
- state severance taxes.

The Proposed Action would generate ad valorem property tax revenue to Sweetwater County, the Wyoming School Foundation Fund, Sweetwater County Schools and various taxing districts within the county. Ad valorem taxes would be generated from two sources: 1) the fair market value of methane produced and sold; and 2) the value of certain capital facilities within the well fields (all underground facilities associated with wells are exempt by State statute). For this assessment, only property taxes associated with production have been estimated.

A constant total levy of 70 mills was assumed for these estimates. In reality some mill levies are set by the Sweetwater County Commissioners, officials of the various special and school districts and the state; some change each year. Mill levies reflect the revenue needs of the taxing entity and estimates of assessed valuation within the entity.

Based on Operator production estimates, US DOE Energy Information Administration price forecasts for natural gas (EIA 2004), and a constant total mill levy of 70 mills, the estimated Proposed Action-related gas production would generate \$38.29 million (2002\$) in ad valorem property taxes to all entities over 22 years, or an average of \$1.74 million/year. Note that property taxes are assessed on the previous year's production and that peak production is not reached until several years after wells come on line, so early production years would yield lower revenues. Of the total property tax revenues, about 70 percent would be distributed to State and local schools and only about 17 percent would be distributed to Sweetwater County government.

Of the 120 wells associated with the Proposed Action, 90 percent are anticipated to be on federal minerals. The federal government collects a 12.5 percent royalty on the fair market value of gas produced from federal leases, less production and transportation costs. Half of mineral royalty revenues are returned to the state where the minerals were produced. In Wyoming, a portion of the state's share is distributed to local governments and to the Wyoming School Foundation Fund.

Based on Operator production estimates and USDOE EIA price forecasts for natural gas, an estimated total \$52.3 million (2002\$) in Federal Mineral Royalties would be generated by the Proposed Action; and approximately \$26.1 million of that amount would be returned to the State of Wyoming. Actual Mineral Royalty revenues collected would vary based on actual production levels, gas sales prices, and production and transportation costs.

The State of Wyoming collects a six- percent severance tax on the fair market value of natural gas produced within the state. Federal mineral royalty payments and production and transportation costs are exempt from this tax. The state uses revenues from this fund for a variety of purposes (e.g., General Fund, Water Development Fund, Mineral Trust Fund, and Budget Reserve) and returns a portion to counties and municipalities.

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An estimated total \$24.7 million (2002\$) in severance taxes would be generated by the Proposed Action. Actual severance tax revenues would vary based on actual production levels, gas sales prices, and production and transportation costs.

Wyoming levies a four percent sales and use tax on the gross receipts of tangible goods and certain services (drilling services are exempted). The state returns 28 percent of the revenue (less administrative costs) to the county and municipalities where the taxes were collected. Sweetwater County also levies a one-percent local option sales and use tax, which is distributed to the county and its municipalities and a 0.5 percent facilities tax. Proceeds from the facilities tax would be used to fund construction of a new county jail.

In drilling the 120 wells associated with the Proposed Action, an estimated \$17.4 million would be spent for goods and services subject to state and local sales and use taxes. This amount would generate about \$698,000 in Wyoming sales and use tax revenues, including \$481,000 for the State of Wyoming and about \$216,000 for Sweetwater County and its municipalities. The local option facilities tax would raise an estimated \$87,000 from Proposed Action-related expenditures (2002\$).

4.12.1.2 No Action Alternative

Under the No-Action Alternative up to 12 wells could be drilled on private surface, which amounts to 10 percent of the wells associated with the Proposed Action. Consequently, using the same assumptions and methods as for the Proposed Action, the effects of the No Action Alternative would be similar in nature to those described for the Proposed Action, but at about one-tenth of the magnitude.

As with the Proposed Action, population effects of the No Action Alternative would be minimal and result in minor and short-term incremental demand for housing and local government services. Non-local employees would contribute to the current housing shortage and service demand in Sweetwater County and Rock Springs but that contribution would be minor.

Using the multipliers obtained from the UW study, the drilling phase would generate about \$9.5 million in total economic impact in southwestern Wyoming, including \$2.3 million in earnings associated with 71 direct and indirect jobs. Under the No Action Alternative, gas produced from the PRPA would generate an estimated \$66.9 million in total economic impact in southwest Wyoming over the 20 year life of the field, including \$3.4 million in earnings associated with an annual average of 4.4 direct and indirect jobs (2002\$).

Under the No Action Alternative, it is likely that both the direct and indirect employment associated with field development and operations would be accommodated by the existing Sweetwater County gas service industry, therefore population, housing and community facilities demand associated with the No Action Alternative would be negligible.

Under the No Action Alternative, production-related ad valorem taxes to all entities would total about \$3.8 million over the life of the field. State severance taxes would yield about \$2.7 million. There would be no federal mineral royalties associated with the No Action Alternative. The drilling program would generate an estimated \$69,700 in sales and use tax including about \$48,000 for the state of Wyoming and \$22,000 for Sweetwater County and its municipalities. The local option facilities tax would raise about \$8,700 (2002\$).

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4.12.2 Mitigation

- The Operator should ensure that its non-local contractors have secured adequate temporary housing for employees.
- The Operator should ensure that all purchases of tangible goods are properly credited to Sweetwater County for sales and use tax purposes.
- The Operator should coordinate emergency response planning with the Sweetwater County Emergency Management Agency.
- The property and sales and use taxes associated with the Proposed Action would provide revenues to local governments in Sweetwater County to offset the anticipated minimal Proposed Action-related demand for law enforcement and emergency response services. However, there would be a lag between the time development begins and the time substantial project-related tax revenues flow to the county.

4.12.3 Residual Impacts

No residual socioeconomic impacts are anticipated.

4.13 TRANSPORTATION

4.13.1 Direct and Indirect Impacts

4.13.1.1 Proposed Action

Transportation effects of the Proposed Action would occur primarily on WYO 430 and SCR 4-24, 4-76, 4-77 and 4-19. These public roads provide access to the PRPA from Rock Springs, where the majority of project related traffic would originate. Transportation impacts would also occur on operator-maintained roads within the PRPA. The increases in traffic associated with the Proposed Action could accelerate highway and county road maintenance requirements and generate short-term increased risk of accidents on state highways and county roads, but successful implementation of mitigation measures would help avoid or minimize these impacts.

Wyoming State Highway 430

The Proposed Action would generate increases in traffic volumes on WYO 430. These increases would result from the movement of project-related workers, equipment and materials to and from the project area to perform drilling, field development, well service, field operations and reclamation activities.

The largest increase in project-related traffic would occur during drilling and field development. Drilling of each well would generate an estimated 171 one-way trips, or an average of 11 trips per day over the 16 day well staking, pad construction, drilling and completion cycle, and the peak daily traffic could be as high as 23 trips. Field development activities such as production testing, construction of gas gathering, water disposal, electrical power distribution and wellhead compression systems would generate additional traffic, during periods when that those activities occur.

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The Proposed Action anticipates drilling 120 wells in two to four years. For the transportation assessment, a three-year, 40 well/year drilling program was assumed. It is also assumed that wildlife and seasonal stipulations would reduce the drilling period to six or seven months/year. Based on these assumptions and a two-rig drilling and field development simulation, an estimated annual 9,894 one-way trips would be generated by the Proposed Action during each year of drilling and field development. This is an average daily traffic (ADT) of 54 one-way trips per day over the six-month day drilling cycle, or an average-annual daily traffic (AADT) increase of 27 trips on WYO 430. On a few peak days, traffic could reach over 100 one-way trips under the simulation conducted for this assessment. It is estimated that about 40 percent of all trips would involve trucks larger than 2½ tons. Note that these estimates reflect a three-year drilling schedule; if drilling and field development occur over two or four years, the annual number of trips would be reduced or increased accordingly.

During project operations and reclamation, daily maintenance and operations activities would be performed by one pumper. Routine well and field facility maintenance would occur on an intermittent basis and incremental one-way trips would average less than 10 per day, except during well workovers, which might average 5 to 10 one-way trips/day for several days depending on the operations that would be performed.

Figure 4-3 contrasts estimated Proposed Action-related traffic estimates with recent Wyoming Department of Transportation AADT counts on WYO 430, at the turn-off to SCR 4-30, the closest traffic count location to the PRPA. Estimated project-related AADT (27) would be about 30 percent of 2002 AADT (90) on WYO 430. However, the Proposed Action AADT and 2002 AADT combined (117) would be less than 2001 AADT and about 43 percent of 1992 AADT for all traffic. Average-annual daily truck traffic would be 54 percent of 2000 levels, but Proposed Action truck AADT (11) and 2002 truck AADT (20) combined would still be less than 2001 truck AADT (35) on this segment. Average daily traffic during the six-month drilling period (54) would be about 60 percent of 2002 AADT, 42 percent of 2001 AADT and about 20 percent of 1992 AADT on the segment. Average daily truck traffic (22) during that period would be about 10 percent higher than AADT truck traffic in 2002, 63 percent of AADT for truck traffic in 2001 and 44 percent of 1992 truck traffic.

While WYO 430 could accommodate the temporary, short-term traffic volumes associated with the Proposed Action with out deterioration in level of service, overweight trucks would accelerate maintenance requirements on the highway and oversize trucks would pose safety concerns on this relatively narrow highway with narrow shoulders and steep side slopes, particularly during wet or icy conditions.

County Roads

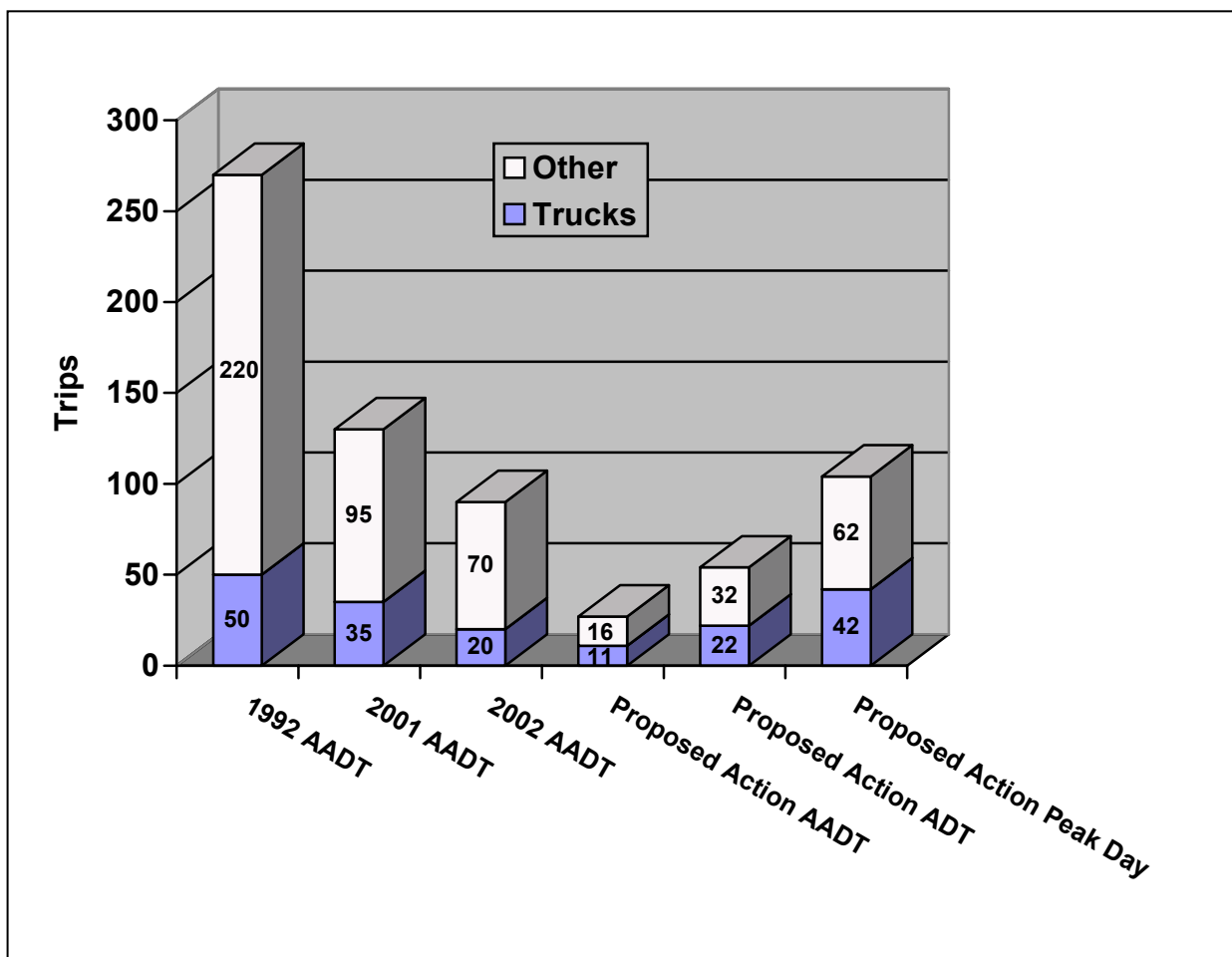
The Proposed Action would result in substantial short-term increases in traffic on the county roads that provide primary access to the PRPA (SCR 4-24, 4-76, 4-77 and 4-19) during the drilling and field development period. Currently SCR 4-24 and 4-19 provide access to oil and gas fields in the area and are improved and frequently maintained, although the southern segments of these roads receive substantially less traffic and maintenance than the more highly used northern segments. In contrast SCR 4-76 and 4-77 provide access to ranches, grazing operations and recreation areas (hunting) and are constructed of native material and lightly used and infrequently maintained, but use of these two roads for drilling and field development access would be limited. The Proposed Action-related increase in traffic, particularly heavy truck traffic, would accelerate deterioration of all county roads. Excessive speed or use of the

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roads when muddy could damage the road surface. Deteriorated roads would result in accelerated road maintenance requirements for the Sweetwater County Road and Bridge Department and potential inconvenience and safety hazards for all road users. The Proposed Action-related increase in traffic would also exacerbate existing dust problems on SCR 4-24 and SCR 4-19 (Gibbons 2004).

Sweetwater County's cost associated with accelerated road maintenance requirements and dust control on county roads would be offset by the Proposed Action-related ad valorem and sales and use tax revenues generated to county government, and by Operator contributions of gravel to the county for use in road reconstruction and maintenance. Although sales tax

Figure 4-3. Proposed Action-Related Traffic on WYO 430 compared to 1992, 2001 and 2002 AADT



Sources: 1992, 2001 and 2002 AADT, WYDOT 2002 Vehicle Miles Book. PA (Proposed Action) AADT, ADT and Peak Day traffic, Blankenship Consulting LLC.

revenues are returned to the county fairly rapidly, property tax revenues from Proposed Action-related production would not begin to accrue to the county until the year after production begins.

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Internal Roads

Section 2.2.2.1 (Road Construction) describes the measure proposed by the proponent to develop the transportation network necessary to access wells and ancillary facilities within the PRPA. The Operators anticipate constructing or reconstructing an estimated 35.64 miles of resource roads to access new well locations including 32.1 miles on BLM surface and 3.5 miles on private or state surface. The Operators would also be responsible for maintaining existing and new roads within the project area. New resource road locations would be identified in consultation with the BLM AO and be designed, constructed and maintained in compliance with the standards contained in BLM Manual 9113.

4.13.1.2 No Action Alternative

Implementation of the No Action Alternative would result in increased traffic on State, county and resource roads because gas leases could be developed on private lands and potentially approved for BLM-administered lands on a case-by-case basis. For the No Action Alternative, it was assumed that 12 wells and associated production facilities would be developed on private lands during one year using one rig. Transportation impacts similar to those described under the Proposed Action could occur, but at a reduced level. Based on a 12-well simulation, an estimated 3,762 one-way trips would be generated during field development. This would be an ADT of 37 trips during the 103-day drilling cycle or an AADT of 10, about 11 percent of 2002 AADT on WYO 430 at the turn-off to SCR 4-30. A projected 61 trips would occur on the peak day.

The effects of No Action Alternative-related traffic on WYO 430 would be substantially less in magnitude and duration, compared to the Proposed Action.

Portions of the same county roads required for access to the Proposed Action would be used to access private and state lands under the No Action Alternative. Drilling and field development – related impacts on these roads would be of substantially less magnitude and duration than impacts under the Proposed Action, but anticipated revenues to Sweetwater County would also be about 90 percent less.

Similarly, the resource road network required to access wells would be substantially smaller than under the Proposed Action. The Operators would be required to construct and maintain resource roads under the No Action Alternative, and to comply with BLM, State and landowner imposed standards for road construction.

4.13.2 Mitigation

Mitigation for impacts on State highways would include:

- Obtaining all required WYDOT permits and approvals for constructing or improving road access to WYO 430.
- Coordination with WYDOT and the Sweetwater Road and Bridge Department to ensure that all approaches to WYO 430 are adequate to handle tractor trailer combinations.
- Coordination with WYDOT and the Sweetwater Road and Bridge Department to ensure that all approaches to WYO 430 are paved or otherwise treated to allow trucks to shed mud gravel before entering the highway.

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Mitigation for County Roads would include:

- Obtaining access permits and/or licenses from the Sweetwater County Engineer's Department for any crossings, access to or utilization through Sweetwater County road rights of way.
- Participation in the Wamsutter – Continental Divide Transportation Planning Committee, if appropriate.
- Operator and contractor policies to reinforce speed limits and other traffic safety laws on county and operator-maintained roads within the PRPA.
- Assistance to the Sweetwater Road and Bridge Department in obtaining gravel, water and dust suppressant for application on affected county roads.

4.13.3 Residual Impacts

Minor increases in traffic associated with production, well and pipeline service and reclamation activities would continue throughout the life of the project.

4.14 HEALTH AND SAFETY

4.14.1 Direct and Indirect Impacts

4.14.1.2 Proposed Action

Potential health and safety effects associated with the Proposed Action include hazards associated with natural gas development and operations; risk associated with vehicular travel on county, BLM and operator-maintained roads; firearms accidents during hunting season and by casual firearms use such as plinking and target shooting; and natural events such as range fires.

Health and safety impacts of the Proposed Action would include a relatively low risk to project workers from industrial accidents, firearm accidents and natural disasters. There would be a slight increase in risk of traffic accidents and range fires for the general public during drilling and field development; that increased risk would be reduced but not eliminated during field operations.

Occupational Hazards

The USDI-BLM, OSHA, USDOT and Wyoming OGCC each regulate certain safety aspects of oil and gas development. Adherence to relevant safety regulations on the part of the operator and enforcement by the respective agencies would reduce the probability of accidents. Additionally, given the remote nature of the project area, and the relatively low use of these lands by others (primarily grazing operators and hunters), occupational hazards associated with the Proposed Action would mainly be limited to employees and contractors rather than the public at large.

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Pipeline Hazards

Increasing the miles of gathering and transmission pipelines within the PRPA would increase the chance of a pipeline failure. However, the relatively small amount of new pipeline associated with the Proposed Action, coupled with the low probability of failure and the remoteness of the project area would result in minimal risk to public health and safety. Compliance with signing requirements for pipeline rights-of-way would reduce the likelihood of pipeline ruptures caused by excavation equipment - particularly in the vicinity of road crossings or areas likely to be disturbed by road maintenance activities.

Hazardous Materials

Drilling, field development and production activities require use of a variety of chemicals and other materials, some of which would be classified as hazardous. Potential impacts associated with hazardous materials include human contact, inhalation or ingestion and the effects of exposure, spills or accidental fires on soils, surface and ground water resources and wildlife.

The risk of human contact would be limited predominately to PRPA operator and contractor employees. A Hazard Communication Program, Spill Prevention Control and Countermeasure (SPCC) Plans, and other mitigation measures described in Section 2.2.11.2.16 would reduce the risk of human contact, spills and accidental fires, and provide protocols and employee training to deal with these events should they occur.

Other Risks and Hazards

Highway and road safety impacts are discussed in Section 4.12 (Transportation). Sanitation and hazardous material impacts would be avoided or reduced by the implementation of the mitigation measures outlined in Section 2.2.11.2.16.

The potential for firearms-related accidents would occur primarily during hunting season. The increased activity in the PRPA during drilling and field development would be likely to discourage hunting in the immediate vicinity of the activity during that period. Consequently the risk of fire arms-related accidents should be minimal. During project operations, the relatively few personnel on site would also result in minimal risk of firearms-related accidents.

The risk of fire in the analysis area would increase under the Proposed Action. This risk would be associated with construction activities, industrial development and the presence of fuels, storage tanks, natural gas pipelines and gas production equipment. However, this risk would be reduced by the placement of facilities on pads and locations that are graded and devoid of vegetation, which could lead, to wildfires. In the event of a fire, property damage most likely would be limited to construction or production-related equipment and range resources. Fire suppression equipment, a no smoking policy, shutdown devices and other safety measures typically incorporated into gas drilling and production activities would help to minimize the risk of fire. There would be a heightened risk of wildfire where construction activities place welding and other equipment in close proximity to native vegetation. Given the limited public use and presence in the project area, the risk to the public would be minimal. There would be a small increase in risk to area fire suppression personnel associated with the Proposed Action.

Based on the foregoing assessment, risks to public health and safety should not substantially increase as a result of the Proposed Action.

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4.14.1.2 No Action Alternative

The health and safety risks identified under the Proposed Action could also occur under the No Action Alternative, given that up to 12 wells could be developed on private and state land. The magnitude of risk would be substantially less than that associated with the Proposed Action. Operators would be subject to the same health and safety standards and regulations as under the Proposed Action, therefore, risks to public health and safety would be minimal under the No Action Alternative.

4.14.2 Mitigation

The Operators should coordinate emergency response planning with the Sweetwater County Emergency Management Agency and provide documentation regarding compliance with Federal Hazardous Material Regulations and the Uniform Fire Code.

4.14.3 Residual Impacts

Risk to health and safety of workers, contractors and other users of the project area associated with industrial accidents, transportation accidents, shooting accidents and natural disasters would remain for the life of the project. However, these risks would be small, given the remoteness of the area, the few employees and visitors anticipated and the proposed mitigation measures.

4.15 NOISE

4.15.1 Direct and Indirect Impacts

4.15.1.1 Proposed Action

Noise levels associated with drilling, field development and operations activities may temporarily exceed 55 dBA, but the lack of human residences and the low level of non project-related human occupation of the project area would result in minimal noise impacts. Although noise impacts associated with compression facilities would be long term in duration, these same factors; lack of human residences and low human densities, would result in minimal compression facility noise impacts.

Implementation of the Proposed Action has the potential to create noise-generated impacts that emanate from machinery used during drilling and completion and during construction of drill sites, pipelines, access roads and ancillary facilities, and from the operation of heavy trucks and related equipment. During field operations, noise would be generated by compression facilities, pumper trucks, road maintenance equipment and by well workover operations.

Noise associated with natural gas drilling, field development and field operations can affect human safety (at extreme levels) and comfort. Noise impacts can also modify animal behavior (see Section 4.7 for a discussion of the potential noise impacts to wildlife resources). The magnitude of noise impacts are contingent on a number of factors including the intensity and pitch of the source, air density, humidity, wind direction, screening/focusing by topography or vegetation, and distance to the observer. A variety of heavy equipment and machinery commonly used during drilling, field development and production operations generate noise levels in excess of the 55 dBA maximum standard. Noise impacts created by these activities

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are short term, lasting as long as drilling, construction or field maintenance activities are performed at well sites, access roads, pipelines, and ancillary facilities. Under typical conditions, noise levels decline below the 55 dBA maximum standard at a relatively short distance (less than one mile from the source) depending on the factors outlined above.

Drilling, field development and field operations workers would be the only groups directly affected by Proposed Action-related noise disturbances for more than a brief period of time. These groups are subject to OSHA regulations regarding industrial noise protection. Grazing operators and recreation users of the area would typically be affected by noise impacts only for the brief period required to pass by sites where drilling, field development and field operations occur.

Natural gas compression facilities would be a source of long-term noise impacts. These impacts would exceed the 55 dBA maximum standard at the compression site, but noise levels would be attenuated to below acceptable levels a mile or less from the compression site. There only one residence located within the PRPA and the Operators would not locate compression facilities within 1.5 miles of this residence. Intervening topography between the residence and compressor stations would further reduce noise impacts. Therefore, field operations workers would be the only group affected by compression noise for other than a brief period of time.

Based on the foregoing and the noise mitigation measures contained in Section 2.2.11.2.12, noise impacts to the public associated with the Proposed Action would be minimal and for the most part, short-term in nature.

4.15.1.2 No Action Alternative

Up to 12 wells could be developed on private and state lands under the No Action Alternative. Therefore, implementation of the No Action Alternative could result in noise impacts similar to those associated with the Proposed Action, but noise generating activities would likely occur at fewer locations. As with the Proposed Action, the few human residences and the low level of non project-related human occupation of the project area would result in minimal noise impacts.

4.15.2 Mitigation

In addition to measures described in Section 2.2.11.2.12, measures to mitigate noise impacts would include the following:

- In any area of operations (drill site, compressor site, etc.) where noise levels may exceed federal OSHA safe limits, The Operators and contractors would provide and require the use of proper personnel protective equipment by employees.

4.15.3 Residual Impacts

Although both intermittent (field maintenance and workover activities) and long-term (compression facilities) exceedences of 55 dBA noise levels would occur for the life of the project, the lack of human residences and the low human occupation of the project area would result in negligible noise impacts.

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4.16 UNAVOIDABLE ADVERSE IMPACTS

4.16.1 The Proposed Action

The Proposed Action would disturb approximately 497 acres, thus increasing the potential for wind and water erosion before the land is revegetated. Other unavoidable adverse impacts are a short-term loss of vegetation and forage production, the temporary loss of livestock forage, short-term turbidity and some sedimentation at local drainages, short-term impacts to air quality /noise levels due to construction activities, short-term loss of pronghorn yearlong winter range, and possible temporary disruption of wildlife activities during construction.

4.16.2 No Action Alternative

Under the No Action Alternative, there would be reduced beneficial economic impacts to local, regional, and national economies.

4.17 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT VS. LONG-TERM PRODUCTIVITY

4.17.1 The Proposed Action

Short-term use of the environment would facilitate and enhance natural gas production and stimulate local economies. Environmental impacts would be short-term and minimal. The proposed project would not adversely affect long-term use and would enhance long-term productivity related to natural gas supplies.

4.17.2 No Action Alternative

There would be no changes in short-term use under the No Action Alternative. Long-term productivity in terms of natural gas production would be reduced.

4.18 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

4.18.1 The Proposed Action

Irreversible or irretrievable commitments of resources would include the depletion of energy, materials, and manpower necessary to implement the Proposed Action.

4.18.2 No Action Alternative

There would be reduced resource commitments under the No Action Alternative.